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# SUPPLEMENT.


# The Mining Journal,

## RAILWAY AND COMMERCIAL GAZETTE:

**FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.**

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## Original Correspondence.

### IRONWORKS AND COLLIERIES IN YORKSHIRE.

#### THE WEST RIDING COLLIERY.

Amongst the leading collieries in what is termed the West Yorkshire mining district, that belonging to Messrs. Pope and Pearson is second to none in the number of persons employed or the quantity of coal raised. At the West Riding Colliery there are some peculiar features connected with it, in the transport as well as in the raising of the coal, which are worthy of special notice. From the Normanton Station the pits are the most conspicuous to be seen around, being only about ½ mile distant from it, situate by the side of the railway, having direct communication by the North-Eastern and other lines to all parts of the North and to the Yorkshire ports, and by the Midland direct to London and the South. A large proportion of the coal raised is sent to Hull, from which large quantities are shipped to the North of Europe, Belgium, France, and other parts of the Continent. There are two seams of coal worked, finding employment for nearly 1000 pairs of hands—one the well-known Silkstone, the other the Stanley Main.

The Silkstone seam is only worked at two collieries in the district, that at the West Riding being reached at a depth of 420 yards, so that it is the deepest, with one exception, of any in Yorkshire. The thickness of the bed is 4 ft. 6 in., there being 4 ft. of excellent coal. In sinking, the Barnsley coal, known locally as the Warren House, was found at a depth of 150 yards from the surface, so that the distance from that seam to the Silkstone is only 270 yards. In the South Yorkshire district, however, the average distance between the two seams has been proved to be about 385 yards. There are two shafts—a drawing and an upcast one—with two 40-in. cylinder engines, and eight ordinary boilers. The ventilation is produced in the usual way by furnace means. They are now putting down something like 1400 yards of endless chain, for hauling the corves up the inclines and levels, to be worked by compressed air. The system of working is that known as the "long wall on end." So little gas is made that the men are able to work with candles, which is, probably, not the case in any colliery of anything like the same depth in Yorkshire. There is a treble deck, the scaffolding at the bottom being moveable, and worked by balance-weights. There is also a patent steam-brake, by Ogden, which works admirably, and has been the means of averting several accidents that might have been attended with serious consequences. It prevents overwinding, and is connected with the machinery, so as to close the throttle-valves as each cage is about four strokes from the top, so that directly after that point has been reached the steam-brake is applied to the drum, all being self-acting. When the cage is above the catches the same operation is repeated by certain arrangements, so that the engineman cannot take the cage the wrong way. The present area of the coal field is about 700 acres, but there is plenty of the seam around to be obtained when required.

The Stanley Main seam is one peculiar to the West Yorkshire district. At Messrs. Pope and Pearson's the bed is only 70 yards from the surface, the coal, comprising "hards" and "softs," being about 5 ft. 6 in. thick. It is worked the same as the Silkstone—long wall on end. There is an engine of 40-horse power, with six ordinary boilers, which also work the pumping-engines. In the pit there is a large extent of chain-road, and the chain is worked by a 24-inch cylinder engine at the bottom. One of the patent brakes is also in operation at the pit. Not far from the Stanley Main are two steam-lifts, for loading the coal that is stacked. As the firm keep their men working during the summer months, when there is little or no demand for house coal, large stocks are accumulated, but by the appliances named the wagons are easily loaded.

A good deal of coal raised is sent from Hull to different parts of Europe, including Hamburg and France, and Messrs. Pope and Pearson run two steamers of their own to various ports. Those gentlemen having been very much inconvenienced by the want of facilities for quickly loading their vessels at Hull, have recently taken out a patent for effecting that object, and by which a great deal of time will be saved, and various other advantages gained. The patent includes a weighing-machine connected with a hopper. The hopper is a large one, capable of holding some 1200 or 1400 tons of coal, and at the bottom of it there is a weighing-machine, so placed that the coal is weighed as it slides into the hold of the vessel. By the contrivance, upwards of 100 tons an hour can be weighed and shipped. Another important advantage in connection with the invention is that the wagons can be unloaded into the hopper at once, and sent back to the colliery. At present the wagons have to wait for the arrival of vessels, but that will be obviated, as we have stated, by shooting the coal into the hopper as the wagons arrive. The Hull Dock Company, we understand, appreciating the value of the new mode of loading, have afforded every facility for carrying it out, for which purpose they have given a piece of land at a moderate or nominal rent. There is every reason to believe that the invention will commend itself to shippers of coal, not only at the Yorkshire but at the other ports, seeing how important the time gained must be, as well as the saving effected by the new system.

It may be stated that the men employed at the West Riding pits are all non-Unionists, and, so far from having suffered by the freedom thus afforded them, are, as a rule, exceptionally well off. They are kept employed all the year round, when the men at other places are having only three or, at most, four days a week, and some of them have the luxury, not enjoyed by many skilled workmen, of residing in their own houses. There are, however, about 300 houses belonging to the firm for the workmen. Education is not overlooked, and a good school has been built, and a master provided for the children, whilst a chapel also has been reared for the use of all who wish for religious instruction, and desire to respect the Sabbath.

The truck system does not appear to be a plant indigenous to the mining districts of Yorkshire, and if found anywhere in the county it is on a scale so small as not to be worth noticing. Co-operative associations, however, grow up in small places, soon take root, and flourish. About three years ago an association was started by the men at the West Riding Colliery, the principal management being entrusted to the leading officials, Mr. Warburton, the courteous and able engineer to the firm, acting as treasurer, and rendering various services in promoting its prosperity. It is now entirely in the hands of the workmen, and is in a highly flourishing state. In appreciation of the services rendered by Mr. Warburton in aiding in establishing the association on a sound and solid basis, the members recently presented him with a silver inkstand and taper-holder, which bore the following inscription:—"Presented by the members of the Altofts and Normanton Co-operative Society to Mr. John Warburton for his services as treasurer. 1871." We believe there is no publichouse nearer to the colliery than Normanton, which by the road will be more than a mile distant, but beer is sold out of doors by the association, so that moderation is a rule observed by the workmen.

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### THE MANUFACTURING INDUSTRY OF SCOTLAND.

#### THE STOBCROSS RIVET WORKS.

Following up our articles on several of the more extensive shipbuilding establishments on the Clyde, we now propose to lay before our readers a description of the Stobcross Rivet Works, which are about the largest and most complete of their kind in Glasgow, and where the operations carried on bear a close affinity to certain other departments of marine architecture. Although the Stobcross Rivet Works were established in 1840, it was not until some 22 years ago that they passed into the hands of Mr. James Miller, their present proprietor, who had previously superintended their operations as responsible manager. The works were originally built on a much smaller scale, and were altogether more restricted in their operations than at present. Although perfectly compact, the additions made from time to time to meet the exigencies of an extended business impart to the buildings a rather irregular appearance. The main entrance is from Stobcross-street, at the western extremity of Glasgow, on the north bank of the Clyde. The buildings appear to form three sides of a square, but there is a large smithy behind, and other accommodation, entirely apart from the premises, which abut upon the front yard. There are ten lever machines and one vertical used for making rivets, but other two of the former kind are in process of construction, so that within a short time there will be 13 different machines regularly at work. At present the average production of the works is at the rate of 230 tons of rivets alone per month, and about 200 hands are regularly employed. The rods from which the rivets are made are procured principally from Coatbridge and Workington. The vertical machine is the invention of Mr. Robt. Griffiths, of whom many of our readers will have heard in connection with his improvement of the screw propeller. We believe the vertical is admittedly superior to the lever machine in many respects, and chiefly on account of its increased power of production. It will turn out, on an average, something like 3 tons of rivets per day, or, in other words, about 60 rivets per minute, as compared with 30 rivets per minute from the lever. Hitherto, however, the vertical has been found difficult to manage. Its construction is of a complicated character; it is readily liable to go wrong, and once out of repair it is not so easy to put it to rights again. For some time past Mr. Miller has been endeavouring to simplify, and render more workable, the arrangements of the vertical, and in this he has been so far successful that when his experiments have been fully carried out he intends to introduce several of the modified machines into his works.

The process of manufacturing rivets is very simple and easy. The rods, which measure from 6 to 12 feet in length, are first put into a heating-furnace, where they are brought to a welding heat. There are two of these furnaces on the works, and in each furnace there are two plates or doors, containing some 10 or 14 holes, just sufficiently large to admit the rods without difficulty. Through these holes the rods are introduced to the furnace, and heated without interfering with the comfort of the man or boy who attends to this part of the business. In other respects the furnaces are similar in appearance and construction to other air-furnaces of the best known kind. As the rods are sufficiently hot for the purposes of manipulation, they are taken in succession from the furnace to the rivet-making machine, where they are cut up into the required lengths by means of a small shears. After passing through this process the lengths are picked up by another man, who wields a tongs in the one hand and a hammer in the other. With the tongs the lengths are placed in dies which correspond with the intended thickness of the rivets, and a good blow from the hammer which the workman wields in his other hand sends them home. There are 10 of these dies or holes for the shaping of the rivets in an ordinary lever machine, and they are placed at regular intervals on a circular iron block or table, which revolves slowly while the process is going on. The dies can be taken from the table at pleasure, and adapted to any size of rivet. In course of revolving a snap or hammer in the centre of the machine comes down upon and gives shape to the head of the rivet, which is delivered by a tilt at the other side. The rivets usually vary from ½ to 1¼ inch in diameter. So much for the lever machine. The vertical works in a somewhat similar manner, with this important difference, that it is self-feeding, and has 16 dies in the table instead of 10. In the furnaces a large proportion of char is used, and the waste heat is utilised to raise steam in the boilers immediately adjoining. The boilers are two in number, one being attached to each furnace, and are of the well-known Cornish two-flued description. There are two engines on the premises. One is a beam-engine of 45-horse power, 16-in. cylinder, and 3½-ft. stroke. The other is a vertical-engine of 14-horse power, 12-in. cylinder, and 2½-ft. stroke. The heavier engine drives all the rivet-making machinery below, and a large fan, made and patented by Russell, of Motherwell, near Glasgow, while the other is used for a number of lathes and other smaller appliances upstairs, as well as to pump water. The whole of the machinery, the engines excepted, has been made on the premises. On the east side of the yards there is a large store used for packing up the rivets in barrels when they are intended for exportation.

In the smiths' shop, which measures about 150 ft. by 40 ft., there are twelve hearths, at each of which two men are employed, and it is in this department that the bolts are chiefly manufactured. Russell's improved fan, to which allusion has already been made, supplies the blast for the whole of the fires, and is driven by two belts off the large engine. The rods for bolt making are similar to the rivet bolts, but the mode of manipulation and the appliances used are different. After being heated at the smiths' fires—which are, by the way, quite unlike the ordinary hearth, in respect that they are enclosed with brick walls, leaving only a small aperture for introducing the rods and for firing purposes—the rod is cut into short lengths of the size required, not by a self-acting machine, but by the workman himself, and these lengths are in turn put into dies, where they are shaped and headed by a hammer worked by the smiths' foot. This machine is called an oliver, and there is one attached to each fire. Nuts are likewise made in the smithy to a considerable extent, but a flat bar of iron is used instead of a rod, and the machine on which they are made is called a fly, the latter being also worked by hand. A separate chimney is attached to each fire, and the shop is ventilated and lighted by large holes in the east and south walls. The fuel used is smithy coal, mixed with char, which gives an admirable fire, and produces very little smoke. Between the smithy and the other departments there is a small yard, in which a well has been sunk to the depth of 120 feet. An ample supply of water is thus continually at hand for the machinery. From this well the water is pumped up into a large iron cistern, which, when full, contains more than sufficient to supply the works for a whole day. An air-pump attached to the smaller engine is adapted to supply the boilers with water from the city mains, the well water containing such a large proportion of lime that its use in the boilers would be highly injurious. Small pipes are led between the principal machines and the large cistern outside, so that the tools are always kept at the requisite point of coolness.

Above the principal rivet shop there is a spacious finishing-room, where a number of women are constantly employed in threading the screws and nuts, and kindred work. The machinery in this department embraces six lathes, a planing machine, a vertical machine, and other smaller appliances used in connection with the finishing of bolts, rivets, nuts, and screws. Here, also, the machines used on the works are made, altered, or repaired. The work at which the women at employed, although it may not appear congenial to one's delicate sensibilities, is neither difficult nor harrassing, but it is very dirty. At one kind of machine they are capping nuts—one of these being capable of capping four nuts at a time, at another they are polishing nuts, and at a third they are putting the thread on two bolts at a time. There is another machine by which the bolts are pointed instead of being turned. A shaft, from which pulleys and belts communicate with the various machines, runs from end to end of this shop, which is heated by the exhaust steam from the boilers. The drawing or scrap from the bolts and nuts is sold to brokers at the rate of 1s. 1d. per cwt., and after being mixed with other scrap it is sold to the forges, or otherwise disposed of.

Although we have indicated that bolts and nuts are made at these works as well as rivets, the manufacture of the latter is carried on to a much larger extent than either of the other two. Shipbuilders, bridge-builders, and boiler-makers necessarily use an immense quantity of rivets, and it is from these sources that the rivet works are mainly employed. Some of the shipbuilding firms on the Clyde make their own bolts and rivets, but the majority of them are dependent upon Mr. Miller's and other works of a cognate description, where they can be better and quite as economically supplied.

It only remains to be added that the Stobcross Rivet Works are now so full of orders that operations are carried on day and night, and a further extension of the works is consequently in contemplation.

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### COLLIERIES IN NORTH DURHAM, THEIR WORKINGS AND MACHINERY—No. XIX.

Murton Colliery.—These pits are sunk to the Hutton seam, a depth of 246 fms. The east pit (sinking commenced Feb. 19, 1838) is 14 ft. in diameter, divided equally by plank brattice; the eastern section contains the pumps, the other is used for coal work. The middle pit, 53 yards from the east pit (sinking commenced April 10, 1838), also 14 ft. in diameter, divided equally by plank brattice, forming two coal pits. In the eastern section the coal of the Hutton seam is raised from the Low Main level, depth 228 fms. This is occasioned by a fault on the west of the pits, riser west 21 fathoms, which throws the Hutton seam on the rise side a little above the Low Main on the dip side. In the western section of the middle pit the Main coal is raised from the depth of 204 fms. The West pit, 71 yards west of the middle pit (sinking commenced July 7, 1840), is used exclusively as a ventilator; its diameter was 16 ft., but this has recently been reduced at the part where tubbing was originally inserted, by an inner casing, to 14 ft. in diameter.

The three winding engines, erected in line with the pits, were applied during the sinking to pump the limestone feeders, and were intended to raise the sand feeders, had not the water proved too strong for them. These engines are all condensing, and of the lever type, the drums and fly-wheel being supported on a side wall and intermediate wood framing, and a metal column. The east winding engine has a 50-in. cylinder, 6 ft. stroke, two 18-ft. flat wire-rope drums; it raises about 500 tons of Hutton seam per day, in three-decked cages, three 10-cwt. tubs in each cage. Four boilers supply steam at 17 lbs. pressure, three 26 by 7½ ft., one 24 by 9 ft. The middle pit winding engine has a 50-in. cylinder, 7-ft. stroke, and two 18-ft. flat rope drums; it raises about 460 tons of Hutton seam per day, and 250 tons per night = 710 tons, with three-decked cages, three 10-cwt. tubs in each cage; supplied from four boilers, two 32 by 7 ft., two 26 by 7½ ft., 17 lbs. steam pressure. The west winding engine has a 50-in. cylinder, 7-ft. stroke, two 18-ft. flat rope drums; it raises about 550 tons of coal by day, and 250 by night, = 800 tons, all from the Main coal seam, with three-decked cages, three 10-cwt. tubs in each cage. Four boilers supply this engine at same pressure, three 26 by 7½ ft., one 24 by 9 ft. The whole of the boilers at Murton are covered with 4½-in. brick arches; they have wheel flues, are hand-fired, and fed by the respective engines.

The pumping engine is erected at the east pit, and was started in May, 1839. It has an 84-in. cylinder, 8-ft. stroke, with condenser, air-pump, and two beams. The main beam weighs 35 tons, and is furnished with strong iron catch pins at each end. The back beam, placed a few feet lower, weighs 12 tons, having a catch pin at the out end. The valves are double-beat, and worked by two air cataracts from four weigh bars. Water is raised in seven lifts from the Hutton seam, depth 254 fms.; six of the columns are in the pit, the top or seventh column is in a staple under the out end of the back beam.

| | | | |
|---|---|---|---|
| Bottom lift, 50 fms..... | 14-in. bucket .... | Worked from out end of main beam. | |
| Second lift, 40 fms. .... | 16-in. ram ..... | ditto | ditto |
| Third lift, 24 fms..... | 16-in. bucket .... | ditto | ditto |
| Fourth lift, 30 fms..... | 16-in. bucket .... | ditto | ditto |
| Fifth lift, 40 fms..... | 16-in. bucket .... | Worked from diagonal-rod and V-bob, from the in-end of main beam. | |
| Sixth lift, 40 fms. .... | 16-in. bucket .... | ditto | ditto |
| Seventh lift, 30 fms. .. | 16-in. bucket .... | Worked from end of back beam. | |

The stroke in each lift is 7 ft. The weight of rods, plates, buckets,

&c., in the pit is 41½ tons, in the staple 5½ tons=47 tons. The water load in the pit is calculated at 38 tons, in the staple at 6 tons=44 tons. A balance-beam, with a counter weight of 7 tons, is placed in a recess at the depth of 30 fathoms. The total dead weight raised in a double stroke is thus 91 tons. The weight raised in the down-stroke of the piston is calculated at 58 tons, and in the up-stroke of the piston 33 tons, giving a preponderance of 25 tons from the top side, which is partially reduced by the balance-beam. The pressure of steam is thus required mainly on the top side of the piston. The area of the piston being 5541 in., and the average pressure obtained assumed to be 24 lbs. per inch at the commencement of stroke, a force of 59 tons is exerted on the top of the piston, which is probably less towards the end of the stroke; this surplus of power being absorbed by the friction of water in the pumps, the friction of rods and engine. The engine performs four strokes per minute, day and night. At 60 gallons per stroke it will raise 240 gallons per minute; with an average pressure of 22 lbs. throughout on the top of the piston the horse-power on that side only would be 118. The horse-power exerted on the under side of the piston, with a lower pressure, will be to add to this to obtain the total horse-power. Six plain boilers supply this engine with steam at 15 lbs. pressure; five are 26 by 8 ft., one 26 by 7½ ft.; these are fed by a pump attached to the engine.

A jack-engine, with beam and metal pillar, 18 in. cylinder, 4 ft. stroke, wheels in ratio of 1 to 4, and 6-ft. drum; this, with main and tail-crabs, cradle-crab and shear-legs, 70 ft. high, are all erected for pumpwork. An engine placed near the West pit is principally used to raise water from the limestone feeders in one of the disused sinking staples; it is also applied as a jack-engine for the West pit, and in hauling coal. There are two 15-inch horizontal cylinders, 16-inch stroke, wheels in ratio of 1 to 2, one 4-ft. drum. It raises water by horizontal rod, two quadrants and two 8-inch close-topped bucket-lifts, 3-ft. stroke, each delivering alternately to a reservoir from which the boilers and colliery houses are supplied, going nine strikes per minute day and night. One boiler supplies steam at 30 lbs. pressure. A small engine in the same house, with 7-inch inverted cylinder, and 6-in. ram, is used to force gas to a gas-holder at sufficient pressure to send it to the bottom of the pits, the main roads and engine-chambers underground being lighted by gas. The headstead and framing, screens and inclined elevators to each pit, are of wood. There are five screens for each Hutton seam pit, and 10 for the Main coal; these are supported by iron columns: 147 coke ovens are built near the colliery, 11 ft. in diameter, dome-shaped, using duff coal from the Main coal and Hutton seams after being washed.

UNDERGROUND WORKINGS.—The Main coal has been worked as yet over a small area, and only in the first working of the bord and pillar system. The pillars are made 44 yards by 33 yards in width; bords, 4½; walls, 4 yards wide. Section of the Main coal as follows:—

| | Ft. | in. |
|---|---|---|
| 1.—Sandstone roof. | | |
| 2.—Top coal, good | 1 | 0 |
| 3.—Good coal | 4 | 4 |
| 4.—Splint | 1 | 2=6 |
| 5.—White stone. | | |

| | Ft. | in. |
|---|---|---|
| | | |
| | | |
| | | |
| | | 6 |
| | | |

The rise of the measures is about 2 in. per yard westward.

The principal cleavage runs north and south, the bords are driven in that direction also, and the pillars removed by 5-yard lifts driven east or west. On the north side of the pit the coal is conveyed by two self-acting inclines, on the west side of the pit an endless chain incline is in operation, extending from the workings 714 yards outwards, the gradient being variable and unsuitable for an ordinary incline. Outwards from this is an ordinary self-acting incline 600 yards in length, and a similar incline southward lands at the pit. The haulage on the south-east side of the pit is by horse-power.

The HUTTON SEAM has been worked over a large area, both in whole working and the entire extraction forming goaf. The pillars, bords, and walls in this seam are of the same size as those above. About 10 bords form a panel: they are generally driven north or south, the wagon-way being on the east side of the panel; this gives ascending ventilating currents towards the opposite side and natural drainage of gas. The pillars are removed subsequently by 5-yard lifts driven east or west against the cleavage. A modification of the long wall system has been some time in operation, and has been attended with success. The face is of the width of 100 yards, the gateways either north or south are 40 yards apart, and an 8-feet wall is built on each side. Narrow places are driven into the solid in continuation of the gateways, the coal on each side of them is extracted by lifts east or west, 6 yards in width and 20 yards in length. About 1000 Davy lamps are in daily use in the two seams; each lamp is tried daily by a "gas tester;" no naked lights are allowed in the workings. Powder is used in the whole workings only under strict regulations. One explosion is recorded at Murton Colliery on Aug. 15, 1848, attended with a loss of 15 lives; apart from this accident the loss of life has been slight, considering the magnitude of its operations. Three engines are in operation for hauling in the Hutton seam, a fourth is being fixed to replace one of them. The conveyance on all the main roads is by engine-power, generally with main and tail ropes, on variable gradients, from level to a rise or fall of 2 in. per yard. The engines are placed at considerable distances from the pits; seven boilers which supply them with steam are placed in the Low Main seam, the two furthest being 60 yards south of the upcast pit, the others much nearer.

The HYDRAULIC BANK ENGINE is placed in the Hutton seam, 290 yards north of the East pit, for hauling on this length, and also on the bank direct east from the engine. It has two 13-in. horizontal cylinders, 4 ft. apart, 22-in. stroke, wheels in ratio of 1 to 3. There are four drums on two shafts—that is, two drums 4 ft. 4 in. in diameter on one shaft, with clutch between; these work the length of 290 yards to the pit, the tail rope pulls 150 yards outwards, where a return wheel is fixed; the tail rope is here knocked off, and the tubs run by gravity to the pit with the main rope attached. The other two drums are 4 ft. 4 in. diameter, on another shaft, with clutch between; these work the east bank to a distance of 1950 yards, where a branch proceeds north-east 220 yards, another south-east 400 yards. At the extremity of each a return wheel is fixed. From the axle of that in the south-east branch a double-acting horizontal pump is worked, with a 5-in. plunger, 2-ft. stroke; this forces water to a point 600 yards above the branch ends through 4-in. pipes. At this point a double-acting horizontal pump is worked by deflecting the rope over and under wheels 4 ft. in diameter; this has a 7-in. plunger, 2-ft. stroke forcing through 5-in. pipes to the engine. Main and tail ropes are used throughout these roads; 30 tubs are run with each set. Two plain boilers, flash flued, supply steam at 50 lbs. pressure—one, 40 by 4½ ft.; and one, 40 by 4 ft. A receiver is placed near the boilers 9 ft. by 3½ ft. in diameter. From this steam is conveyed by 7-in. pipes in a drift to each engine; at each engine a receiver is placed, 6 ft. by 2 ft. in diameter. The steam from the engines escapes at once into these pipe drifts. The steam pipes for the new engine, before referred to, will be 10 in. in diameter.

The HAWTHORN ENGINE, placed in the Hutton seam, near the East pit, has two 12 in. horizontal cylinders, 4 ft. apart, 18-in. stroke, pinion-wheel, 2 ft. one spur-wheel 5½-ft. in diameter. Two 3-ft. drums on one shaft, with clutch between. The engine-road in connection with it proceeds south-east for 1050 yards, where an east branch of 290 yards takes off. The tubs run in by gravity over these two lengths; the main road continues south-east to the second east branch, and in that branch a return wheel is placed; in this length of 750 yards the tubs are pulled in and out by the engine, the tail rope being attached at 1050 yards to haul inwards, 24 tubs are run in each set. Two similar boilers supply this engine, one 42 by 4 ft., one 41 by 4 ft. The south-east road is continued further to a total length of 2560 yards from the pit, that portion beyond the second east branch being worked by horse traction. As these roads will be extended greatly in an east direction, and are intended to be driven to the eastern boundary, under the shore of the German Ocean, the new engine is nearly ready to replace that last described. This has two 30-in. horizontal cylinders, 16 ft. apart at their centres, 5-feet stroke, pinion 6 ft. 2 in., two spur-wheels 8 ft. in diameter; two 8-ft. drums on separate shafts, with clear front, and slide carriages. Two Lancashire boilers are being put together for this engine, placed in the Low Main seam, 90 yards north from the upcast, each in an arched chamber, 13 ft. wide. Each boiler is 30 by 7½ ft., tubes, 2 feet 10 inches diameter; eight Galloway tapered tubes in each 2 feet 10 inches tube.

The HALLFIELD ENGINE is placed in the Hutton seam, on the rise side of the 21 fms. fault, 330 yards west of the Middle pit, which it supplies. This has two 18-in. horizontal cylinders, 4 ft. apart, 2-ft. stroke, pinion 3 ft. 4 in.; two 8-ft. spur-wheels and two shafts, on each shaft a 5-ft. drum is placed to haul in and out on the south road, a length of 2000 yards to a siding, where coal is supplied by a series of three self-acting inclines going westward. At this point three double-acting horizontal pumps are worked from one axle by deflecting the tail rope over three 4-ft. wheels; each has 6-in. plunger, 1-foot stroke, and forces through 5-inch pipes to the engine. From this siding the engine road proceeds south-east a further distance of 800 yards, where a return wheel is fixed. From the axle of this wheel three double-acting horizontal pumps are worked, 6-in. plunger, 1-ft. stroke, lifting to the former pumps through 5-in. pipes. Beyond the return wheel to the south horses are employed for a length of 440 yards, beyond this a length of 500 yards is worked by self-acting incline. The total length of engine road is 2800 yards; 48 tubs are run in each set, hauled in and out by the engine. This and the other return wheels are 6 ft. in diameter, all placed vertically. Another shaft, with 6-ft. spur-wheel, and two 3-ft. drums on it, is also put in motion by the main pinion. There drums are placed below the 5-ft. drums, and work the 330 yards of road from the engine to the pit. A return wheel is fixed about midway in this length; the full train is hauled out thus far by tail rope, where it is disconnected, and the tubs run by their gravity to the pit with the main rope attached. Three boilers supply this engine with steam at 50 lbs. pressure, of 37, 38, and 40 ft. length, 4½ ft. diameter. The seven plain boilers are placed in line, at varying distances from the upcast, each in an arched chamber 8 ft. wide; each boiler flue joins a main flue, as a passage for the heat and steam to the upcast; these flues are all flanked by side flues to protect the adjacent coal, and are carefully stowed with sandstone above the arches.

The ventilating furnaces are placed in the Main coal seam, near the upcast—one 13 ft. by 6 ft., and one 9 ft. by 6 ft. in length.

| | | |
|---|---|---|
| The circulation of air in the Main coal workings is | 68,680 | cub. ft. per minute. |
| The circulation of air in the Hutton seam is | 169,640 | ditto |
| The circulation of air for the boiler fires is | 28,630 | ditto |
| The circulation of air for the stables is | 3,000 | ditto |
| Total ascending the upcast, as measured in the mine | 269,950 | ditto |

THE SINKING OF MURTON PITS.—The difficulties encountered in this undertaking were unprecedented in this coal field. Several boreholes were put down previous to sinking to prove the thickness of sand. The strata sunk through in the Middle pit to the floor of the Hutton seam, obtained in April, 1843, consist of—

| | fm. | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|---|
| Outset | 1 | 0 | 0 | | | |
| Alluvial deposit | 5 | 3 | 0 | | | |
| Magnesian limestone | 69 | 3 | 1 | | | |
| Marl slate, or fish bed | 0 | 2 | 0 | Fms. | ft. | in. |
| Sand, with much water | 4 | 3 | 8= | 80 | 5 | 9 |
| COAL MEASURES—Seam | 4 | ft. | 9 | in. at | 178 | 0 | 0 |
| Main coal | 6 | 2 | | at | 204 | 1 | 2 |
| Maudlin seam | 1 | 1 | | at | 212 | 4 | 11 |
| Low Main | 4 | 7 | | at | 228 | 0 | 2 |
| Hutton seam | 5 | 0 | | at | 246 | 0 | 4 |

The thickness of sand in the East pit was 34 ft. 6 in., and in the West pit 26 feet. The limestone feeders were successively stopped by cast-iron tubbing as the sinking proceeded. The surplus water was raised by the three winding-engines. The top lift of pumps in each case was placed in a staple 30 fms. in depth, under the crank shaft; the middle lift and the ground set were placed in the respective pits. When the sand feeder was tapped it was soon found necessary to have the large pumping-engine erected, but the engine-power was still inadequate to contend with the formidable quicksand, owing in a great measure to the scouring action of the sand on the pumps and buckets. The quantity of water raised at this time was calculated to be 3285 gallons per minute, with four engines. After this the sinking of the West pit was commenced, and two high-pressure engines erected, each 56-in. cylinder, and 450 nominal horse-power. With six engines and pumps well arranged, operations were again commenced in putting three pits through the sand. The old method of piling was adopted to put them through. The pits were first widened out to 21½ ft. in diameter. Two rings of curbs were laid, 8 in. square, with an annular space of 5 in. between; in this space the piles, 9 in. by 4 in., and 10½ ft. in length, were driven into the sand by large hammers; when these were driven their full length the sand within was extracted. As this was done curbs were fixed into the piles every 2 ft., until the sand was extracted to near the bottom of them, when a second length of piles was driven between another pair of curbs, as before. The pits were reduced in diameter 2 ft. by each length of piles. The difficulties were greatly augmented by the action of the sand on the pumps and buckets; the leather used for the buckets is stated to have cost at one time 11*l.* 5*s.* per hour. Gutta percha and metallic buckets were tried, with little success. The sinking of the West pit was then stopped, and clear water only pumped there, while the other two pits were being piled. This was attended with good results, and they were finally secured through the sand. The West pit was subsequently piled and secured in the same manner. The wedging of the tubbing in the latter pit was completed on Feb. 5, 1842. Next day, however, 14 courses of tubbing were more or less displaced, caused by the pressure of the air behind. Pipes were inserted after this, and carried up to the standing set cistern, to prevent a like occurrence. The tubbing varied from ⅝ in. at the top to 1¼ in. thickness at the bottom of the limestone and through the sand; the courses were 2 ft. and 18 in. in height. At the sand tubbing metal rings, 9 in. deep, were fixed in front of each horizontal point. The total engine-power used during the pumping operations was equal to 1584 horse-power; steam supplied from 39 boilers. A double column of 19-in. pumps, in three lifts, was connected with each of the three large engines, and a single column of 16-in. pumps, also in three lifts, to each of the three winding-engines. The quantity of water raised from 75 to 80 fms. in depth was thus, with six 19-in. pumps, 8-ft. stroke, 12 per minute, 6912 gallons per minute; three 16-in. pumps, 5-ft. stroke, nineteen per minute, 2394 gallons per minute: total, 9306 gallons per minute. For lifting the pumps, rods, &c., five pairs of main and tail crabs were used. For suspending the ground sets nine pairs of ground crabs, with the spears, blocks, and ropes to connect them with the ground pumps, were used, besides three cradle crabs and three gins. The three pits were finally completed to the Hutton seam in April, 1843. The two large pumping-engines are removed. The depth of tubbing in the West pit is 52 fathoms. It has been found necessary recently to place an inner casing of tubbing and brickwork within the old tubbing, which showed signs of failing in this pit after being in its position 27 years. The tubbing has been cased to the extent of 52 fms., strengthened by rings at the joints, as in the first insertion.

## RATING—TAXING—AND MINING.

SIR,—I beg you will favour me with space for these few lines in next week's Journal. Your correspondents, "P." and "R.," agree pretty well on this subject, and in case income from every other source is taxed I think all of us who advocate no taxing or rating on mines will have an uphill game to fight, if we go to convince our legislators and the public in general that mining royalties and profits ought to be exempt from such payments. "P." estimate the amount of property untaxed, and not rated to the poor, at 1,500,000,000*l.*, and to make up this huge sum, which is far beyond the grasp of my mind, although not too large to be true, he includes the National Debt in all its forms and all incomes, foreign and colonial, also iron mines, fire-clay, pipe-clay, pottery, and brick-clay, cement, limestone, gravel, and sand pits, earth, fire, water, ships, barges, boats, trucks, trade, and professional profits, &c., "visible and invisible." Since the publication of "P.'s" letter in the Supplement to the *Mining Journal* of April 8, much controversy has taken place, on the general principle for taxation therein proposed; and, although "P." has given us the new idea of rating the landlords of all property, mines, &c., we must not forget the helping hand of "R.," who seems fully imbued with "P.'s" general principle. "P." and "R." evidently know, and have perhaps felt, that mining is a speculation, and if any property, income, or profits in this country are allowed to go free of rates and taxes the tenants or speculators in lead, copper, and tin mines, or more properly speaking adventurers in them, have a special right to our consideration, and exemption from rating. The lords who receive their rents and royalties are not included in the exemption from rating either by "P." or "R.," because the landlords run no risk; and as a rule they are so protected that in case the tenant sells ore they are sure to receive their full royalties and rents, regardless of the well or ill being of others. It has, however, been contended by some that the royalty or rents of mines must in justice to the landlords be considered as sale money of a part of the estate, and on that account not to be rated. This brings us back to the property before the pit was sunk, and we ask was the mine at that time of any value to the landlord? The answer is, "No!" nor would it have been of any value had not money been found by the adventurers to employ labourers to bring the minerals to the surface; and it is too frequently the case that those who find capital employ labour, run all risk, and spend their last shilling on a poor mine, pay the rent and royalties to landlords, not out of profits, but out of capital. And this is always the case where the cost of the ore is more than the price for which it is sold. In this case, I ask, do such payments represent a part of the value of the estate? Certainly not. It is cash out of the pockets of the adventurers, for which they have had no consideration. And as yet no evidence has been given which has proved to my satisfaction that the royalties paid on metalliferous mines should not be looked upon as a rent paid for room to employ labour for the well being of others.

Great as the sum may appear which your correspondent, "P.," has estimated the unrated property of this country at, there is no doubt in my mind that he is below the true value. In a conversation I had a few days ago with a party who is as well up as most men in matters connected with our doings and investments in other countries, it was stated that the people of this country have property in other countries in stocks, shares, banks, land, mines, railways, &c., of greater value than the amount named by your correspondent, "P." But let us for the time being be content to accept his calculations, which, if rated at the sum of one shilling in the pound, will produce no less an amount than 75,000,000*l.* per annum. These figures are doubtless facts, and I hope that they will reach the eyes and understanding of every ratepayer in this country. This is the time to press forward in this great work of justice to ourselves, as on the consumation of our wishes so much depends the future hopes, comforts, and well being of the middle and industrial classes of Old England: 75,000,000*l.* per annum will amount to 3*l.* per head on the population of this country, and between four and five times more than the whole amount of the local taxation of the country, which is stated by Mr. Goschen to be about 16,000,000*l.* per annum, the pressure of which has given rise to the worst feelings and desires, contempt and hatred to the laws, discontent, loud murmuring, and demonstrations of disloyalty. These are strong reasons why the suggestions of "P." and "R." published in your wide spread Journal, should be made known to those in whose hands the nation confides its future hopes for peace and prosperity.

S.

## THE GOLD FIELDS OF URUGUAY.

SIR,—Can any of your readers say what has become of the Uruguay Gold Mining Company, if such a company ever floated? A paper was read in the session of 1869-70, by Mr. H. Bankart, at the Royal Geographical Society, wherein he stated that he had discovered a rich placer of gold in the department of Tacuarembo, at a place called Corralles, some 200 miles north-east of Monte Video. The gold seems to be very abundant, and the assays, from specimens which he procured with his own hands, "yielded on assay from 87 ozs. to 6512 ozs. to the ton of ore;" and he considered that "from the reefs a fair average of 2 ozs. to the ton might be reckoned upon." He stated further that he (Mr. Bankart) was deputed to England to select and purchase the necessary buildings, and machinery of the most approved principle, for carrying out the views of the company. He added:—"I pursued my researches for about 90 miles in length on the course of the lodes, and stretching 18 miles across them."

If such a rich auriferous country really exists in the republic of Uruguay, within a month's communication by lines of steamers now running, and where railways are now being established, it seems odd that it is not more known, for I learn that the Government of this fertile and healthy republic are only too anxious to obtain European settlers, and will grant any quantity of land, as rich for agricultural purposes and the production of the vine, &c., as the richest provinces of France can produce, at 4*s.* an acre, with perfect freedom of religion, and immunity from taxes of every description. F. R. G. S.

*Exeter, May 2.*

## CERRO DE PASCO, AND ITS SILVER MINES.

SIR,—This place, in the Republic of Peru, is situated on the top of the Andes, on the eastern side of the Western Codillera. It stands about 15,000 feet above the sea level, and is said to be one of the highest, if not the highest, inhabited place of importance in the whole world.

From Callao to here is a distance of 160 miles, but, in consequence of the rapid ascent in such a comparatively short distance, it is considered a quick journey if mules make it in six days; it more frequently takes them a week, and at times, during the season of snow and rain, the pampas, which are the table lands of these mountains, are impassable for several days together. These pampas bear no vegetation but a stunted kind of grass, which merely keeps alive, but never appears to grow, and the only animals which subsist on it with any success are the llamas. These are woolly and ruminating animals, with slender legs and cloven hoofs, with a head and neck resembling a camel, are about the height of a donkey, but have smaller bodies. They are also beasts of burden, and are frequently termed the camels of South America.

The Codillera is a tilted ridge of mountains, stretching along on the top of the Andes from south to north, with high conical peaks, covered with eternal snows. They are distant from here about 5 leagues, and when the sun shines out in all its splendour they have a most beautiful effect; but their appearance is still grander during clear moonlight. Standing here on an eminence on a bright sunny day in this upper stratum of rarefied atmosphere, with my face towards the south looking into the immense distance, these snowy peaks seem as it were to be coming out from the sky; and when I turn and look northwards they there seem to be passing into the sky—an endless procession of hoary-headed rocks.

The town of Cerro de Pasco, which at present numbers 10,000 souls, is of no small importance, considering its great altitude and inconvenient distance from the coast, but it lacks order and design in every part. The streets are crooked and uneven, and the houses are stuck about anywhere and everywhere, with the greatest display of uneducated taste that I have ever before witnessed; moreover, it would be difficult to find another such place so equally dirty. The dogs are so numerous that the authorities compel a periodical poisoning of them. A man is sent about the streets with lumps of food containing poison, which he throws to all the dogs he meets with, and wherever they fall down and die through this medium, quite a number of them are allowed to remain until they disappear through the slow process of putrefaction. There are also other kinds of filth, too vulgar to mention—in fact, it abounds in all the stinks.

The food we get is extremely poor and coarse; the beef is so tough that a person might with very little stretch of the imagination fancy himself to be chewing uncooked tripe. The mutton is ditto, with this exception, that it has more the flavour of a he goat that died during hot weather. Practically speaking, the diet is not sufficient to sustain European nature.

It rains and snows on these heights with not much cessation for about six months in the year, and in what is termed the dry season there are also frequent falls of snow. Furthermore, water boils at 180° Fahr. instead of at 212°, as with you; consequently, it requires six minutes to cook an egg.

The majority of the inhabitants are a low type of Indians, who are small both in stature and mind, but are large in cunning, and have exceedingly plain features—not possessing the slightest trace of the noble features and bold simplicity of the Indians of the North. They are, too, extremely dirty in their habits; they seldom ever wash themselves, because they say it produces sickness, nor do they ever comb their heads, and, barring the rags which partly cover them, may be said to be in a rather primitive state of existence, but their teeth are beautifully white, well shaped, and regular. A great number of the women of this class of people have a leaf or a small piece of paper, about the size of a halfpenny, stuck fast under and sometimes over the eye; its appearance forcibly reminds one of its resemblance to a postage-stamp, and is worn, I am told, as a charm

against headache. Some of them wear a couple of stamps, one under each eye, as if overweight. All these Indian folks, both male and female, are great drunkards; their chief beverage is a drink called "chacta"—an extract from raw sugar, the temperature of which is at about freezing point, and very noxious to the taste. I think it kills them off at an early period, because old men and women are scarce amongst them. The wealthier classes of the people are chiefly the owners of mines and haciendas (reduction works), some of whom are very agreeable society, and have a good general knowledge, especially of mineralogy and metallurgy, but many of them are proud, ignorant, and conceited. The organ of self-esteem is developed to an extraordinary degree beneath the cranium of this latter class of the natives, and as he moves gravely along, wrapped within the folds of his long black cloth mantle, he appears, as it were, to be puzzled only on one trivial point of creation—whether it was God or whether it was himself who tilted up the Andes.

The geology of this mineral region consists of blue limestone, sandstone, porphry, conglomerate, firestone, and granite. These rocks constitute the mountains of Gauricocha, which surround the town and its vicinity in an almost complete circle, there being only one outlet of importance, which is by the Lake of Quiulacocha. The pampa, or plain, reposing at the foot of the mountain is 1 league in diameter, and which is the famous Mineral de Pasco.

Any person acquainted with minerals and mining coming up to Cerro de Pasco would fancy that the whole town was built on the back of one huge lode; go wherever one may, through the streets, or on the outskirts of the town, and even up to the slopes of the hills surrounding it, he finds it to be all lodestuff everywhere; its composition is what we Cornish miners generally term an iron gossan.

When Capt. Richard Trevithick, the famous Cornish engineer, visited the spot, in 1816, he pronounced this mineral formation to be a vein or lode; but, notwithstanding such an eminent authority, I differ from him in this matter, and consider it to be almost a horizontal deposit, with a bearing north and south, and dipping slightly towards the east—resembling more a funnel-shaped mass in its formation than a metalliferous vein. Moreover, in sinking perpendicular shafts in it, I think it not at all unlikely that before they will have reached to any very considerable depth they will be found to pass through this mineral deposit, and penetrate the underlying stratum.

The greater portion of this mineral spot is parcelled out into setts or grants, which consist of pieces of ground 60 yards in length by 30 in width, giving to the place no less than 664 mines. At present there are no more than 78 of them at work, and only 63 of which are producing ore, and the united returns amount to 2,000,000 ounces of silver per annum. Each owner or company have roads leading down to their mines, formed of steps cut out in the rock, dipping at angles varying from 30° to 50° degrees. When you have descended to the depth of the mines the levels or holes leading to many of them are so small that one has to drag himself along snake fashion until he reaches the main excavation. The miners break down the silver ore with pointed bars of iron, and then shovel it into bags made of hide with the shoulder-bone of some animal; after which the stuff is carried to surface on men's and boys' backs.

The silver is generally found in sulphurets in irregular beds, and in numerous cases the ore thus deposited extends over a great area. When all the mineral has been extracted there remains an immense excavation, and in consequence of the roof not being properly supported with timber, one risks his life in entering it. Heavy falls of rock frequently occur, and by which means a vast number of persons are annually killed. One day in the last century, at the mines of "Matagente" (which word means kill people), which are situated in the rising ground on the northern side of the town, and while a great number of men and boys were at work the roof of one of these immense chambers, consisting of many thousands of tons, fell in without giving the least warning, and "in the twinkling of an eye" the souls of 300 Peruvian miners rushed into the presence of their Redeemer. Their bodies have never been exhumed, and their shattered bones still remaining, will bear evidence of the catastrophe to future explorers. An adit has been driven through the district, beginning at the Lake of Quiulacocha on the south-west, and terminates at the mines of Ganacaucha on the north. The entire length of the adit, including its branches, is about 3 miles, and its average depth from surface 50 fathoms. Three perpendicular shafts, situated at about 600 yards apart, have also been sunk from surface to a short distance below the adit.

Messrs. Wyman and Harrison, the former a mining and the latter a railway engineer, have contracted with the Board of Miners at this place for the sinking of two of the above-named shafts to the depth of 45 yards below the adit, and also for the erection of four 75-horse power pumping-engines, two of which to be placed on each of the shafts. The water at the Mesepata shaft, on the north, is very abundant—gushing up from the bottom at the rate of 800 gallons per minute. At the latter, Gauricocha shaft, on the south, the water is at present comparatively little, being only sufficient for one 9-in. pump with a 4-ft. stroke, worked by a 15-horse power engine, at the rate of 9 strokes per minute, but the ground through which this shaft is being sunk is of the most difficult kind which mining engineers have to contend with; it consists of very soft pyrites of iron, which runs through the smallest crevice, consequently it has had to be close timbered with the heaviest kind of timber, and hung with iron bolts for the whole distance down to the present bottom, which at this time is 31 yards under the adit. There remain only 14 yards more to be sunk, which probably may be completed by June next. The former shaft (Mesapata) is suspended until the arrival of the more powerful engines and larger pitwork.

The whole of the machinery for the mines in question, which are being made and dispatched by Messrs. Harvey and Co., of Hayle, Cornwall, consist of four steam pumping-engines, six boilers, four iron main beams, four balance, ditto, and also a sufficient quantity of 24-in. pitwork for both shafts. No single piece of all this cumbrous machinery must weigh more than 300 lbs., in consequence of its having to be transported on the backs of mules from the coast to this mountainous region. Although the main distance be no more than 160 miles, these beasts with their burdens have to climb an altitude of 15,000 feet before they reach their destination. Moreover, the passes in ascending the Andes and Codillera can only be correctly imagined by experienced travellers. Some of the defiles are not much wider than a sheep-path, and with a thousand feet below you a roaring cataract, and thousand of feet above you snow-capped over-hanging mountains, looking so dreadful that the awe-struck stranger in the pass fears that the next peal of thunder will cause them to topple.

You will perceive from the above that this undertaking is surrounded with difficulties from the beginning to the ending. The rarefaction of the atmosphere is so great that men by only doing very moderate labour become at once prostrated for want of breath. In the next place the bad state of the ground, and the abundance of water at the shafts, and what is far worse than all the transport of the machinery over roads where the most daring of English fox hunters would scarcely risk his horse. All things reckoned, this mining enterprise is probably the greatest of the kind on record.

In performing any kind of work, a moral encouragement is invariably a great stimulous to the parties engaged in it, but it strikes me that this spot does not contain much of that quality. Although the contractors may enter upon and carry out undertakings formerly stated to be impossible, the only apparent recognition is a shrug of the shoulder and a grunt of unthankfulness.

I observe in a paper which is now before me, entitled "the Introduction of the Steam Engine in the Peruvian Mines, by Richard Trevithick, in 1816," that when Captain Trevithick arrived at Lima on board of the ship Asp, with sundry small engines for the draining of the mines of Cerro de Pasco, he was immediately presented to the Marquis de Concordia, then Viceroy of Peru, was most graciously received by the most flattering attention of the inhabitants, and subsequently the Viceroy ordered the Lord Warden of the mines to escort the great man with a guard of honour to the mining district. In contrasting the two epochs, that of Trevithick in 1816, with this of Wyman and Harrison in 1871, one is led to exclaim that there were *gentlemen* in Peru in 1816, and they gave unto Cæsar that which belonged to Cæsar.

W. R. RUTTER.

*Cerro de Pasco, Peru, February* 24.

P.S.—There are many important coal veins within five leagues of here, which I hope to visit shortly, and in which case will endeavour to furnish you with some account of them in a future letter.

## "TITLES" TO AMERICAN MINES.

SIR,—In the *Mining Journal* of March 11 I find a correspendent enquiring—"Can some of your American correspondents give us their views about titles to mines in the United States—which is preferable, first location or United States patent?" &c.

The law is plain. A United States patent to a mining claim, whether placer or lode, is equivalent to a fee-simple title in England, and supersedes the "right of possession" of the original locator, because, before such patent is granted, all adverse claims are heard and "proceedings stayed until a final settlement and adjudication, in the courts of competent jurisdiction, of the rights of possession to such claim."—See Mining Act, July 26, 1866, sect. 6, from which I quote. Should an adverse claimant to the right of possession fail to lodge his claim with the Registrar of the Land Office in whose district the mine is situated, within 90 days from the date of the publication of the statutory notice of application for patent, he cannot do so afterwards, and the patentee will hold the mine against all comers.—See same Act, section 3.

LEWIS CHALMERS,
Manager of the Exchequer Gold and Silver Mining Company.

*Bulliona, Alpine County, California, April* 8.

## MINING—FOREIGN AND COLONIAL.

SIR,—In a letter you were good enough to publish in the Supplement to the *Mining Journal* of April 15, amongst other New Zealand mines I drew attention to the Caledonian Company's property, quoting figures for the operations of the company during the month of January. As the progrees of this mine is interesting, and even startling, will you permit me to give the following additional report for the month of February?

| | Tons of Quartz. | Ozs. of Gold. | Month's Dividends. | Price of Shares. |
|---|---|---|---|---|
| January.. | 350 | 2441 | £0 16 8 | £15 0 0 |
| February.. | 350 | 27,255 | 23 0 0 | 100 0 0 |

In this company there are only 2830 shares. The area of the ground is slightly over four acres. A reef of bluish quartz, from 6 to 10 feet thick, strikes through the entire ground, and dips or underlies at an angle of 45°. This reef has only been reached within the last three or four months, and from the above returns it will be seen that the small quantity of 700 tons of quartz has yielded no less than 29,696 ozs. of gold. The whole of this seems to have been got while merely driving the levels and connecting them by winzes, preparatory to stoping out. In September last shares in this really splendid mine were selling languidly at 10*l*.

W. EARL.

*The Avenue, Beckenham, May* 2.

## MINERAL WEALTH OF MARMATO.

SIR,—With the object of furthering mining operations in this country, and particularly in these districts, I make free to offer some information as to the character of the lodes, which until lately have been, as it were, unexplored—the almost unexampled wealth of the country adjacent has been suffered to remain almost undeveloped. Gold, silver, coal, and copper are to be found in great abundance; many rich silver lodes are now being wrought in the several districts of Marmato, Sapia, and Riosucio. Cinnabar, too, probably more important than the auriferous deposits, has been discovered both in this State and in that of Antioquia. Salt here is unusually pure, and the springs are sufficiently abundant to supply all exigencies. Copper ore and valuable mines also have been discovered; ironstone is also abundant, and after the development of the coal seams, which up to the present have only served for the foundry and smiths' work at Marmato, but which do not appertain in any way to this company—that is, that of Marmato—I have no doubt would become extremely profitable in the hands of monied speculators.

The late mining discoveries in the vicinity of Marmato, situated in the State of Cauca, and bordering on that of Antioquia, render it one of the best fields for speculation which this country at present offers. There cannot be a doubt that these young mines will soon take a first-rate position, and by their profits give to mining generally a greater impetus. Lodes recently discovered (uncovered rather), and which at first were supposed not to be worth 20*l*. per ton, have now per assay given 2·40 per quintal, or about $60 per 100 lbs. This is by no means strange, where silver lodes have rather to be quarried at first than worked in a professional manner.

A confidential man of business should proceed to this locality immediately—of course, possessing common sense. A gentleman who feels the responsibility of laying out cash—capital—three months would be sufficient for such a person to form an opinion as to the reality of the above.

The writer, in conclusion, would state that sugar-cane, sugar, coffee, cafetella, cauchtouc, rice, tobacco, Indian corn, cotton, quina, cacao, fancy and dye woods—in a few words, it would require much time to enumerate the natural productions of this neighbourhood. Suffice it to say that seeing such riches I endeavour to instigate speculators, or at least to draw attention towards one of the healthiest and richest corners of the earth.

A RESIDENT OF TEN YEARS IN THE DISTRICT.

*Marmato, March* 1.

## MINING IN SWEDEN—THE SOLSTAD MINES.

SIR,—The discussion of questions vitally affecting the success of mining through the medium of the *Mining Journal* is a proposition which denotes an awakened interest, growing out of practical necessities. An interest created by such a cause is one equally valuable, as it is significant of an apprehending faculty that a higher ground is attainable, and may be assumed accordant with the recognised fundamental principles as a guide to mining. The best prelude to knowledge is a combination of its absolute utility and power, accompanied by a thirst or aspiration for its attainment.

The communication under the above heading in your issue of February 25 points in directions which if pursued lead to and open up a field of view in physics as instructive and edifying as it is interesting. The consideration of the faulting and dislocation of metalliferous and other veins cannot long be pursued without the mind resorting ever and anon to the phenomenon of rock formation and other kindred subjects. To philosophise is inseparable from the human mind, and no state of entity or being can engage its attention which does not imply an antecedent force or energy, as well as its ulterior condition of things. This is a fact now so patent to man's intellectual susceptibilities, that its admission is always conceded as a foregone conclusion; and enquiry proceeds hence to ascertain, and if possible to investigate, the *modus operandi* of beneficent Nature in this department of her vast empire.

The knowledge which includes and comprises this branch of the physical sciences is the acquisition and reward of close observation and reasoning *a posteriori*. The circumstances detailed by your correspondent are not new to me, nor were they prior to my leaving England. It is asked in the article to which this has reference what relation the intercepting clay and trap veins detailed bear to the slides or flookans of Cornwall? From the relative position of the two classes of veins, as given by Mr. Sprague, I have no doubt that nineteen out of twenty miners, whose experience has extended to a like condition of things, would be that the detailed intersecting veins are relatively to the lodes of the Solstad Mines what slides are to the mines of Cornwall. During the time of my connection, as one of the agents, with the Wheal Mary Ann Silver Lead Mines a beautiful series of slides occurred there, the effects of which were diverse from those of the Solstad Mines, both in regard to the direction of displacement and the productive qualities of the lode, which, instead of being impoverished, was invariably enriched by the occurrence; unless, as once was the case, when the obtruding slide proved intersecting instead of conjoining, and passed beyond a few feet to the east of the lode. It then assumed a converse parallel with it, which it maintained for some distance, but subsequently approximating, re-crossed the lode, took up its ordinary position under it, and shortly merged, losing all identity, entirely in the lode itself. In order to be perspicuous, it will be necessary here to say that the general direction of these slides was from north to south magnetically, whilst that of the lode was north 26° east, and south 26° west, consequently the slide's approximating angle to the lode was 26°. Their dip also was relatively to the lode at about the same angle; and as the line of displacement was always towards the greater angle, the lode beyond had always to be sought, and was invariably found on the descending plane of the slides, and which in miners' parlance is "thrown down." These slides were preceded by two beautifully coarse-grained porphyry dykes, which when in a state of decomposition were found very congenial to the productiveness of the lode. The more advanced the stages of decomposition, the more productive was the lode found to be, and *vice versa*. These dykes were about 60 ft. in width, and in direction and dip were conformable to the slides—or, rather, the slides in the descending order were conformable to them.

There can be no doubt that many displacements of lodes are accompanied by corresponding displacements of the contiguous rocks, and hence the term "fault," which as applied designatory of such a condition of things is one the most characteristic. Occurrences of this kind are by no means general, as in the unstratified and older metamorphic rocks, in which the most prolific fissures abound, as in Cornwall, the system of faulting is unknown. The faulting of strata is evidently the effect of direct mechanical action—force or pressure exerted, whether immediate or remote. But all horizontal displacements resulting from this agency appear to be more exceptional than general, as evidenced from mining in Cornwall, as well as elsewhere. It is a question at present by no means easy to answer, how far, if at all, the severance and apparent displacement of the lodes of Cornwall have been affected by mechanical agency. Such a state of things it is more than probable may be confined to certain classes of rocks, of which the carboniferous are lucidly representative, and have not the most distant relation to the hypogene rocks, which were formed under vastly superior pressure.

It is sufficiently within the limits of possibility to be esteemed probable that fissures may be formed, and be still forming, as they are now found, replete with metalliferous minerals, without for a moment its being predicated on sufficient internal evidence that the containing and contiguous rocks were removed the distance which is found to obtain between separate sections of the same lode on opposite sides of a cross-course.

The relation of non-metalliferous to metalliferous veins, their intersections, or conjunctions, as the case may be, and the effects produced, sometimes reciprocally, is a study best pursued, all other things being equal, by practical observation, the facts of which can only be esteemed a legitimate basis upon which to theorise in respect of more obscure but not less apprehended truths. Organic laws have hitherto been confined to the animal and vegetable kingdoms, but the question, if premature now, may ere long arise, how far such a restriction is arbitrary? It is not at all improbable but that as the anatomy of the earth's crust becomes better understood a system of functions, no less vital in their affections, may be found to prevail therein. If the veinous and arterial system is an organisation in the animal structure, it has a striking analogy in the mineral as well as in the vegetable kingdom.

The formation of mineral veins appears to me to be due to the circulatory system of fluid matters, and entirely dependent thereon. From such conclusions, it is unnecessary to say that the aqueous agency must be accepted as principal and primary in the formations of metalliferous deposits.

In the circulatory system egress as well as ingress of the vital currents—no less vital as pertaining to the veins of the earth's crust than to the capillary and other functions of animal and vegetable life—is clearly implied; and thus an outlet of excrementitious matter is provided, as well as an inlet of congenial fraternising substances, which on entering the fissures are arrested, deposited, and disposed by the joint action of the attractive and affirmative forces. Chemical action, thus commenced, goes on, aided by electricity, until the perfectly formed crystal, metallic and mineral, results.

In pursuance of this subject we are inevitably led to but one conclusion—the recognition of two distinct agencies in operation, producing vertical and horizontal displacements, apparent or real, as the case may be, of both lodes and their containing rocks. The vertical, and approximately vertical, displacements are unquestionably due to the direct action of mechanical force, whilst those of the horizontal are more apparent than real in a large number of instances, and are due to a totally distinct agency. The sectional conditions found to characterise the metalliferous fissures in the lower metamorphic rocks appear to be, and to have been from all time, in *statu quo*, and to have sustained no mechanical movement subsequent to the commencement of chemical action, in its most incipient stages in their formation and repletion.

The carboniferous rocks evidently afford the best exposition of the effects of mechanical action in the displacement of rocks, whilst the lower primary rocks present almost irrefragable proofs that the sectional condition found to obtain therein is due, in everything besides the remotest conception of mechanical power, to an entirely different state of things—the action of chemistry under pressure greater than that the carboniferous rocks ever sustained. It would be extremely difficult to conceive a system of faulting to exist in the non-stratified and non-fossiliferous rocks, like that which prevails in the carboniferous, or even in the upper silurian, rocks.

No theory which predicates the opening of fissures for the purpose of metalliferous deposition to be but by gradual and progressive enlargement and filling up of fissures by selected and congenial substances, such as chemistry alone can effect, is entitled to receive the stamp of philosophical endorsement, or likely to become popular. If such a fissure were opened by mere mechanical agency, whether gradual or abrupt, a like condition of things must ensue: it would be merely a chasm, to be mechanically filled by heterogeneous substances, which under moderate pressure, and decomposition of some of the softer material, would simply coalesce by cementation, and result in nothing but a dyke of conglomerate or breccia, or both, as circumstances purely accidental should determine.

Carrying out the idea of organism as pertaining to the earth's crust, figurative though it may be, or utterly utopian, and limiting our view to the aqueous agency—formation of mineral veins by infiltration—it is easy to conceive, if not to explain, the relations subsisting between metalliferous and non-metalliferous veins, and what purpose each is subserved by the other. It is conceivable, with great show of reason, that the dividing lines in rocks which subsequently were wrought into fissures for the reception of metallic minerals, might have been formed at the time of indurations of the rocks in which they are found, whether from contraction by their loss of water or loss of heat is immaterial; and, notwithstanding the immense pressure to which they were afterwards subjected, it might have been wholly insufficient to obliterate the seams thus formed, as matters mutually repellent may have been forced into juxtaposition, and as no power in nature is known to be equal to the bringing into actual contact any two particles of matter, we may, without doing violence to accepted truths, admit that such a division as that which eventually expanded—not mechanically, for at such a stage the mechanical had ceased to operate—into a prolific metalliferous fissure, might remain intact throughout the future ages of time, or be gradually preparing, as is probable, under chemical activities for the reception and deposition of embryonic metals, destined to be future sources of wealth, ministering to the necessities, conveniences, and comforts of mankind. There is nothing which I am aware of involved in this theory dissonant with the recognised functions of nature, and no forces marshalled but those which are known to be in constant operation in the mineral kingdom. The crust of the earth, especially those parts of it which are metal-bearing, is percolated by waters known to be charged with acids, which coming into contact with every particle entering into the composition of rocks—as it does, or has done at some time or other—performs only its natural functions as a solvent, in reducing and absorbing, for which it has ample capacity, and conducting, for on it is the impress of malleability, to some receptacle manifestly fitted and designed to receive, mould, transmute, and transform the shapeless infinitesimal particles deposited into tangible bodies, assuming the definite and characteristic forms, and as useful and indispensable in all the conditions and stages of civilised life as they are beautiful. I could adduce facts which have come under my own observation, both in this country and in Cornwall, to redeem the views I enunciate on this subject, from even the mild, though no less stern, expression of visionary. And to show that the sectional con-

ditions of metalliferous veins may be due to vastly different agencies than those so unqualifiedly asseverated and implicitly accepted.

The mechanical dislocations of rocks obtains, because so impressive and convincing to the senses; and because, in this part of the world at least, its effects are not unfrequently associated with sublimity. Scientific men may sometimes in the juvenility of a science accept, and endorse as general, an effect which ultimately turns out to be due to a definite and specific cause. There is superabounding evidence that lodes in passing cross-courses are found at greater or less distances from their longitudinal direction on the other side; but whilst such is the case, there is not only the absence of all evidence that the contiguous rocks have been removed, but there is the presence of strongly presumptive, if not of absolutely positive, evidence that they have not. The perfect correspondence of rocks on either side of a cross-course would be sufficient evidence on this point were all other wanting; but there are others, one of which, and not the least potent, is that whilst some lodes are found as if affected by displacement, others, but a little distance therefrom, are found to abut the cross-course on either side, unaccompanied by the slightest deviation from a straight line. If it should be argued here that the latter class of lodes were formed subsequently to the cross-course, and the apparently dislocated vein anterior to it, it would amount to nothing more than an argument in favour of the theory I am striving to enunciate. If it be admitted that the formation of mineral veins—fissures—is the result of direct chemical action, certain functions must be supposed analogous to those prevailing in animal and vegetable nature; and the continuous round of change denoted by the terms formation, decay, life, death, &c., may be applied with equal propriety and with equal significance in the mineral as in the other departments of nature, and hence something strikingly analogous to organisation be, at least, presumed as prevailing in the rock formation constituting the earth's crust.

The relation of cross-course, slide, elvan, and all other dykes intersecting the prolific lodes would, from our assumed stand-point, be more clearly apprehended, and intelligible conclusions as to their utility be deduced therefrom, whether as channels conducting to or leading from the fissures destined to become first receptacles, and then sources of the precious and all the other metals.

*Ellsworth, Nye Co., Nevada, April 5.* ROBERT KNAPP.

[For remainder of Original Correspondence see to-day's Journal.]

## THE SOUTH AFRICAN GOLD FIELDS.

A very interesting communication has just been received in this country from Mr. T. BAINES, containing the result of his nearly two years' exploration of the Matabele country, on behalf of the South African Gold Fields Exploration Company of London. The exploring party, of which Mr. Baines was chief, was accompanied by Mr. C. J. Nelson, a mineralogist and miner of great experience in California, and Mr. R. J. Jewell, secretary of the company, Mr. G. W. Watson, Zulu interpreter, and Mr. John Lee, a gentleman well acquainted with the Matabele language, laws, and customs, and the personal friend of the late chief, Moselekatse. The Governor gave Mr. Baines a letter conferring on him the position of a messenger authorised to make researches and to convey information to him, and requesting the special friendship and protection of the chiefs for him in that capacity. Mr. Lee, who had long told Moselekatse that when the English Government sent messengers it would do so in good faith, told Manyami at once to send messengers to announce Mr. Baines' arrival with a party on important business, which could only be explained to the great chief of the nation himself. In about a fortnight (during which Mr. Nelson did as much exploration as was safe) two subordinate chiefs arrived, sent by Um Nombati, the Regent of Matabeleland. They demanded Mr. Baines's business, but Mr. Lee severely reprimanded them, and asked—"Since when it had been the law that they as messengers must pry into the business of a visitor, instead of conducting him before their chief?" He gave them the information he thought fit, and showed them the outside of the Governor's letter with the royal arms on the seal. At Emampanjene, Messrs. Baines and Nelson (Watson and Jewell, with one wagon, having been left at Kumalo, or the Royal River) were admitted to the presence of the venerable old chief—decrepit in body, and naked as an animal, unable to move even a few feet without support, but clear and vigorous in intellect as when he was seen by Capt. Harris in 1837, acting as chief counsellor to Muselegasi (which name Mr. Baines uses for Moselekatse), and obtained permission to explore on condition of not leaving the country without first reporting himself to Um Nombati.

After some delay, caused by the election of Lo Bengulu as successor of Moselekatse, King of the Matabele (and Mr. Lee having brought the matter forward), the new king said he was satisfied with what had been done, and that Mr. Baines could have the northern gold fields. At the village of Umtigesi, a Mashona chief, on one of the sources of the Sabea river (latitude 18° 47′ 46″) Mr. Baines saw no traces of gold. He continues—"Again I rode with Mr. Hartley 20 miles N.W. by N., to see ruins of a Portuguese house, deserted 40 or 50 years ago. We did not find it because elephant spoor again came in our way, but we saw extensive reefs and abandoned gold workings, and the elephants got away into the Fly. We made another turn to the east of our station, and on Sept. 1 shot two rhinoceroses, and found a place well adapted for a sanitarium, when we began to work. I then turned to with the wagon-drivers and native servants to break out quartz, Mr. Hartley helping me to look for gold, and Myassi doing the same, the chief value of his services, however, being the proof thus afforded that I was most indubitably acting on the orders and permission of the king. On Sept. 9, Mr. George Wood invited me to his camp, about 60 miles N.N.W., and I accepted, and rode with him. The first night we halted by an extensive quartz hill, and next day we reached his wagons in a country extensively quartzose, with old workings all around, and a renewed working within sight. We were about six miles east of Maghoondas, where I was last year, and the enquiries I then made had stimulated them to seek out their old workmen, and renew their ancient industry. Mr. Wood took me to a place in which he had seen a heap of quartz burned, and another heap piled with wood among it ready for burning, the crushing-stones, like a painter's slab, and muller lying in a hut near. When I was there these slabs had gone and the calcined quartz, but the other heap had been fired, and now lay burned, ready for removal. Mr. Wood had brought a few grains of the gold in a quill, and this he very kindly presented to me, and I consider it an inestimable gift, for though its intrinsic value is very small it is incontrovertible evidence that gold exists, and may be obtained by very simple means. It is, indeed, no more than I knew in 1859, but it enables me to prove it to the company. Mr. Wood made enquiries for more, but the poor wretches seemed to be in dread as if they had committed a mortal crime, and dared not confess what they had done. During the homeward bound journey, I rode with Mr. Hartley, and he pointed out several reefs. One day I had the pleasure of riding close up to a herd of between 150 and 200 elephants, and was in at the death of seven out of eight that were killed. I did not fire, not having a hunter's licence. Another time Mr. Hartley sent his man, who had formerly acted as guide to Mauch, down the Sebaque and Bembesi rivers. I saw some fine reefs and old workings; but I shot a rhinoceros, a buffalo, and two pigs, and the men were so well fed that they cheated me out of the sight of the particular reef they ought to have shown me. At Myate we were gladly welcomed by Mr. and Mrs. Sykes and Mr. and Mrs. Thompson. The latter had already grown and reaped a wheat harvest; and I found the fact of the king having given me the gold fields was so generally known and recognised among the Matabele that once, when I said I wished to see the king soon, Mporth, his brother, said to me,—'Why need you be so anxious; do we not know the king has given you the country?' I ought to have mentioned also that Kokotoi and Umtigran told Mr. Lee, 'We are glad the king has given Mr. Baines the gold fields; one thing can only be given to one man, but they are given not to him personally, but the great white men who sent him.'

"One Sunday the king asked to see the quartz I had brought down. Mr. Lee explained that we did not go into business on that day, and he assented, but asked 'only to look with the eyes.' I showed him a bag, and picked out a piece in which a speck of gold was visible, and Mr. Lee explained how small was the proportion of gold in so great a mass of stone, and how great was the labour required to extract it. I showed him the sample in the quill which Mr. Wood had bought from the Mashonas. He asked why I did not at once go on working, and I told him because Mr. Nelson, who was the skilful man, had not arrived. He suggested that Mr. Nelson would be tempted by the richness of the diamond fields, but I assured him I believed he fully intended to return and work with us. Mr. Lee asked whether he was perfectly satisfied with the manner in which I had acted on the privileges he had granted me, and he said Yes, he was perfectly satisfied, and he had no reason to complain or repent, and he would not withdraw his favour till I should do something to forfeit it. In fact, Mr. Lee told me that so far as the king's favour was concerned I might span the oxen in at once, and either go back to the gold fields to work or to his farm to pass the summer, but I told him I would stay to have a regular official and business-like confirmation of the king's promise during the week."

On Nov. 23, 1870, the king visited Mr. Baines, and asked whether he had found gold in his country. Mr. Baines told him he had found some, but could not tell exactly where it existed beyond the two or three places in which he had seen it, neither could he tell how rich or poor those spots might be, not being skilful in mineralogy, but that he had dug out and brought away the small specimens he had seen, and that these he must send home to skilful men to be crushed and tested in various ways, which Mr. Lee explained to him. The king told Mr. Baines that he might go in and take the gold, but that when he had done so he must leave his country to him, meaning, as Mr. Lee explained, that though he gave permission to work the gold he did not divest himself of the territorial right to his own country. Mr. Hartley also considered his permission as a concession of all the privilege the company could desire for working the gold fields. The king asked what return Mr. Baines could make for the privilege he had granted him, and, after some conversation, the king said he would not fix a price nor take a fee, neither would he bargain about the amount of a present, lest it should be construed into a purchase of the land, so Mr. Baines arranged on coming in to make him such a present as he thought he would be pleased with. The land granted is not in the district of Sofala, neither is it in those of Senna or Tati, but lies considerably to the north of Tati. The north and south boundaries of the territory are 80 miles apart, the breadth is the ridges of rock in which the auriferous quartz is found. It is believed that the quartz is very rich in gold, and the district has been largely worked to a moderate depth at some past period in the world's history, and seems to have yielded well.

## THE MINERAL RESOURCES OF CHINA.

Although comparatively little is known in this country concerning mines and mining in the Chinese Empire, it seems certain that they are not altogether neglected. Of the mineral wealth of Szechuen, and the western provinces, only a mere sketch can be given. The commonest product under this head is coal, which is found in abundance everywhere from below Pa-tung-hien to Chungking. It is worked by a cheap and easy process on the hill sides, is sold at the pit's mouth in some places at as low as 30 cash per picul (say 2½d. per cwt.), and is very generally consumed both for domestic and manufacturing purposes in all parts of the country. Around Chungking itself the coal mines are particularly productive, and constitute a rather important item in the industry of the neighbourhood. The best quality of coal is said to be that found near Khwei. The only complaint the natives have to make against it is that it burns too fast; hence they economise by pounding it small and mixing with earth, so forming a kind of patent fuel, which they call *lan-yuen*.

The metal trade is not regarded as of very great importance in Szechuen, but metals generally are under Government monopoly, or are permitted to be worked under Government license. Gold bars are brought from Kweichow and Yunnan, and are also made out of the gold dust found in the bed of the Kinshaklang or Golden Sand River, by which name the Upper Yang-tsze is sometimes known, and which is no mere fanciful appellation. The waters of the river are undoubtedly charged with gold, which is annually deposited among the pebbles in its bed. On the subsidence of the summer flood the natives commence washing for gold, beginning at a short distance below Wan, and extending to the upper part of the river.

The occupation is not very remunerative—the workmen have little left after paying the license to the authorities; and in case they did improve their fortunes by a successful search, there is little doubt that the taxes would be increased. Silver comes from Yunnan and Kweichow. Copper and white copper (petung) are found in the provinces of Yunnan and Kweichow, and are taken for sale to Jinhwaiting. White copper also comes from Hwuylichow, in Ningyuanfoo, in Southern Szechuen. Only a small quantity of Chinese red copper comes to market at Hankow. Spelter (peyuen) comes from the same quarter, and is also collected at Jinhwaiting. It is used to mix with copper, to manufacture cash, and is at present reported to be sent in large quantities to Japan. Tin (seih) is found in Yunnan, also in Hoonan and Kweichow. The produce of Yunnan and Hoonan is collected at Yuenchowfoo, the other at Jinhwaiting. There are several qualities, the best being called tienseih. Lead (hihyuen) is said to come from Tungchuenfoo, in Yunnan. Quicksilver is found in Kweichow; sulphur in small quantities there also, and in various parts of Szechuen. Iron is very abundant and very cheap in Szechuen. Chingyuchang, in Chingtoo prefecture, is mentioned as a place where it is produced in large quantities; in Yunnan it is also abundant, and used locally.

The province of Kweichow is, perhaps, the least known of the eighteen into which China is divided. It has suffered severely by a war with the mandarins, cholera, and other epidemics, so that one town, for example, of 50,000 inhabitants was reduced to 200 families, of which but six belonged originally to the place, the remainder being immigrants from Szechuen. The aggregate result has been to reduce the population from 6,000,000 to less than 1,000,000. The Catholic bishop resident at Kweiyang, the capital, who passed down the Yangtsze last May, described the country between his residence and the borders of Szechuen as a depopulated jungle, and the trees as having been everywhere cut down by the ill-paid soldiery for fuel. Kweichow, though less fertile than many other provinces of China, has still elements of prosperity in its available resources. It is rich in mines of lead and copper, but especially of quicksilver, which latter were being worked to great advantage previously to the late rebellions, but have not been since resumed.

The province of Hupeh contains, as far at least as is known, but little coal, but it is always necessary to remember that what the Chinese call bad coal, and not worth working, may after all overlie some really valuable deposits. Nowhere in Hupeh are there any largely worked or important mines. At some hills, not far from Anluifu, on the Han River, a poor earth coal is found and used in the coarse pottery works in that city, but is not exported elsewhere. At Ichangfu, on the borders of Szechuen, a rather better coal is found and exported to places in the immediate neighbourhood. In the neighbouring province of Hunan large and valuable fields of bituminous coal exist and have long been worked. The district is traversed from north-east to south-west by the Hsiang River, the principal feeder of the Tungtinghu. It is mountainous, and intersected by small streams, whose waters are subject to all the vicissitudes incidental to mountainous districts, and the continual, sudden, and very violent rains peculiar to Hunan do not diminish the dangers from floods either to the mines or the boatmen conveying the coal down to the depôt at Hsientanhsien. The coal field lies in the jurisdiction of the three prefectures of Yungchowfu, Henchowfu, and Paochingfu, and may be roughly estimated as extending about 30 miles from north to south, and about 33 from east to west. Near Paochingfu a non-bituminous coal, called iron coal, is found and is extensively used in potteries, and for smelting iron; it is exported in considerable quantities, and in the distilleries, felt factories, and forges at Hankow, and elsewhere. The chief mines for this coal are stated to be at Nieumassu and Chiangshulwan, about 30 li from the prefectural city.

With regard to the mines themselves, they are driven horizontally into the sides of the hills, and often penetrate them to a considerable depth. These shafts, or rather passages, are of no great size, and average about 4 feet wide by 6 feet high, and necessitate the miners working in a stooping posture; their roofs are propped up at intervals by wooden supports, and the rotting or breaking of these is a fruitful cause of accident, men being often crushed to death by the displacement of portions of the roof. Still more dangerous are the floods and heavy rains which are frequent in Hunan, and many miners are annually destroyed by the sudden flooding of the mines, or by the destruction wrought in the roofs and sides of the passages by the damp and wet. Fire-damp, however, so fatal in English mines, seems unknown, or nearly so, to the Chinese more simple methods of excavation, though it is stated it occasionally appears, but never in very large quantities. Agreeably to Chinese customs the system of co-operation seems generally prevalent, and each mine is the property of one or more families, who contribute the men and the material for working it, afterwards dividing the profits among themselves. As the hills are the property of the State, large proprietors are unable to monopolise these sources of national wealth, and no rent troubles these humble mine owners beyond the land tax universally due to the Emperor from the eighteen provinces.

In addition to the great coal field above treated of, there remain two other small districts, one in the extreme south of Hunan in the magistracy of Hsintien-hsien, whose produce is said to be considerable, and of value; but which is all sent southwards into the adjacent provinces of Kuangtung and Kuang-hsi; no very accurate, reliable, or detailed information can, therefore, be obtained about it in Hankow. The other is in the magistracy of Loong-shan-hsien in the Prefecture of Yung-shun-fu in the north-west corner of Hunan, bordering on Szechuen. This coal field is reported to be extensive, and was worked as far back as the times of the Ming dynasty, but it is now said to be exhausted, and a little, but very inferior, coal is obtained from it. It is, however, by no means impossible that foreign skill might discover fresh deposits deeper down in the earth, and render once more valuable these now nearly useless mines, as it is likewise certain that acquaintance with the foreign methods of mining would render still more productive the great central coal field of Hunan, and the possible more universal introduction of steamers for the navigation of the inland waters of China will soon render necessary what is now a mere matter of speculation—namely, that the practically unlimited resources of fuel in Hunan should be opened up and rendered fully accessible of foreign skill, energy, and capital. With how great advantage to the people of China it is needless to state. No accurate statistics are obtainable of the amount of coal annually brought down from Hunan. The foreign steamboat companies consume nearly 16,000 tons per annum, and the extent of country depending for supplies of fuel on Hunan must be very large. The valley of the Yang-tsze is probably the principal market, and the vast population dwelling on its banks appears to depend for its fuel chiefly on Hunan.

Returning to Szechuen, it should be mentioned that salt is another important source of its wealth. It is produced in many parts of the province, as in Foochow and in the prefecture of Khwei, but the largest supplies are found in Wotungkeaou, in Keatingfoo, where *kihpa*, a white kind, is made from springs; in Sz'lewkin, in Fooshunhien, where another white kind, called Sz'yen', is made; and in Shayhunghien, in Tungchuenfoo, whence it comes in black and white blocks, some white and some very dirty. A license is necessary to enable a merchant to deal in salt, which is said to cost 20,000 taels, besides paying which the applicant is supposed to find security for his possession of sufficient capital to carry on the trade. The license remains in the family, transmissible from one generation to another, but each successive holder is required to pay 10,000 taels to the mandarins, besides making them frequent presents. So the matter was described to us, but in point of fact the cost of a salt license probably depends on the terms which the holder of it can succeed in making with the mandarins.

The salt trade of Szechuen received a very important stimulus from the closing of the navigation of the lower Yang-tsze, in consequence of the capture of Nanking, and the occupation of the river by the Taepings. Up to that time the whole of the provinces of Hoopeh, Hoonan, Kiangsi, and Anwhuy, had been supplied with the "Hwai-yen" salt, so called from its passing Hwai-kwan barrier, to its depôt at Yang-chow, all other salt being contraband. But when communication with Yang-chow had been stopped, the Viceroy Taou petitioned the Emperor to permit the Szechuen salt to be brought for sale to Hankow, which was, of course, granted, and Szechuen salt kept possession of the market until the opening of the river navigation by foreigners in 1861. The "Hwai-yen" salt again began to come to Hankow in 1862; and for some years past Tsengkwo-fan has been making great exertions to bring the trade back to its old channel, petitioning to have the Szechuen salt again interdicted in Hoopeh.

Time will be required, however, before the trade can be organised on its former footing, for the old monopolists, or Yen-shang, were dispersed by the rebellion, and the mandarins have been obliged to grant licenses to new men of inferior standing, called Yen-fan. The authorities are, however, making every effort to place the matter on a permanent basis, compelling applicants for license to go to Peking, and making the license not transferable. The Hwai-yen salt arriving in Hankow is placed under the control of an officer, called "Tuhseao Hwai-yen-keuh," who regulates the price at which it shall be sold, and the order in which the boats shall discharge, the owner having no voice in the matter. With Szechun salt it is different, for having paid duty at Ichang on the way down it is henceforth free from official interference.

## THE GOLD MINES OF VICTORIA.

The official returns for the quarter ending December, 1870, for a copy of which we are indebted to the Secretary for Mines, Mr. R. BROUGH SMYTH, are of a satisfactory and encouraging character. The total number of miners employed was 59,247, of whom 28,281 Europeans and 15,015 Chinese were employed in alluvial mining, and 15,887 Europeans and 64 Chinese in quartz mining. The number of square miles of auriferous ground actually worked upon was 938¼, and the number of distinct quartz reefs actually proved to be auriferous was 3037. The approximate value of the mining plant used was 2,128,896*l*. In alluvial mining 403 steam-engines were employed in winding, pumping, &c., of the aggregate horse-power of 9915, and there are 608 heads of stamps. In quartz mining 711 engines are employed, of the aggregate horse-power of 13,572, and there were 6522 heads of stamps. The alluvial miners obtained 196,707 ozs. 3 dwts. of gold, and the quartz miners 174,480 ozs. 13 dwts., equal to 371,187 ozs. 16 dwts. in all.

The registrar for the central division of the Ballarat mining district (Mr. Harrie Wood) reports that there is reason to believe that the mining interest at Ballarat is in a fair way to recover its former prosperity, and that many of the miners who formerly depended entirely upon the earnings of wages in the larger mines now, when not so employed, form co-operative parties to re-work portions of the old ground in and around Ballarat East. At Rokewood Junction, in the southern division of the Ballarat district, a party of nine has been getting as much as 25 ozs. per week. Mr. R. M. Harvey, the surveyor and registrar for the Buninyong division, writes that there can be no doubt but that an excellent field for prospecting, with every chance of finding gold in payable quantities, exists in the country to the west of the main Durham lead, along the continuation of the belt of auriferous quartz reefs which runs from Hiscock's southward by the Homeward Bound along the Durham ranges, and he anticipates that valuable discoveries will be the result of the present rush along this line of country.

In the Beechworth division of the Beechworth district the registrar, Mr. A. Alderdice, reports that the miners at Woolshed and its tributaries are making fair wages. Several of the smaller creeks are being worked for black sand (tin). This class of mining is now employing an increased number of men, and in wet seasons it is generally more profitable than gold mining. Doubtless in years to come tin streaming in this division will be the regular avocation of a large number of men, as every creek and gully falling from both sides of the ranges contains black sand. A fine-shaped light straw-coloured diamond, weighing over 1¼ carats, and which was sold to a jeweller for 4*l*., was picked up in Snakehead Creek, a tributary of Young's Creek. In the Buckland divisi n the registrar, Mr. L. C. Kinchela, reports that the result of the new process for extracting the gold from pyrites now being carried out by the proprietors of the United Happy Valley Company has been eminently satisfactory, showing an average of over 11 ozs. of gold per ton obtained from the blanketings, &c., which had passed over the tables and copper-plates, and of which 60 tons were saved. This does not refer to the richer residue (12 cwts.), which had been carefully put aside for a subsequent manipulation by the mining manager. In the Maryborough mining district the mines at Carlsbrook manifest signs of prosperous development.

In Fryers Creek division of the Castlemaine mining district Mr. Mark Amos, the surveyor and registrar, reports that the Australian United Gold Mining Company are actively engaged in cross-cutting for the eastern lode, which they expect to intersect within some 30 ft. of their present drive. The manager is still sanguine of ultimate success. The Anglo-Australian Company have nearly completed the erection of a splendid plant—a Cornish beam-engine, 75-horse power nominal, with pumping and all other appliances; also a 40-horse power engine, with ordinary winding-gear. At a depth of 93 ft. they struck a lode 18 in. thick; the stone is supposed to be of a highly auriferous character, yet the proprietors intend sinking to 300 ft. before they raise any quartz for crushing. In the Taradale and Kyneton sub-division the same company (the Central, near Taradale) continues to obtain grand results (so says report), but the registrar, Mr. Thomas Orwin, regrets to say that it is impossible to ascertain correctly the result of the operations of this and another claim in his division.

THE GAS WELLS OF ERIE.—It is something worthy of extra notice to find a city lighted, and its dwellings warmed, with natural gas, procured merely at the expense of boring for water. Erie rejoices in this blessing, and the subject is still sufficiently new to be interesting. The first presence of gas was noticed four years since, in digging a potash well within the city limits, the flow of gas from which nearly suffocated the workmen. This well was filled up, but the same result occurred in another near by. Experiments were then made by sinking tubes in the mud of a stream and igniting the escaping gas, which burned freely. To a Mr. Brevillier, an intelligent German, is due the first practical action. This gentleman associated with a few others in a company, sunk a well for petroleum on his premises; as an oil well it was a failure, but as a gas machine a splendid success. For three years it wheezed and *gas-ed* until, the lease of the company expiring, the proprietor laid pipes conveying the gas to his house and soap-works, where it has since been used. Not one pound of coal has been consumed since then in the establishment. The various processes of melting, rendering, and soap boiling are carried on with gas as the fuel, the building is illuminated, while a beacon on the roof lights that portion of the city. With all this, and the amount used for lighting, warming, and cooking in his dwelling, but one-sixth of the gas furnished by the well can be used, the remainder escaping through a safety-valve. At the Conrad Brewery a gas well was lately opened, by which vats of lager are kept boiling, and malt ovens working with an even temperature, the steam gauge standing at 75 day after day, without a change of a pound per day, and all without care from anyone. The uniformity of pressure keeps the steam of flame under the boiler or kiln at an exact strength, supplying the most perfect heat for brewing. But one-fourth of the gas from this well is used. The city, also, has utilised the product with the happiest results. A well was put down by the City Gas Company, near the main reservoir, which has yielded a uniform daily supply of 24,000 cubic ft. This is conducted directly into the reservoir, and 12,000 ft. of manufactured gas added, thus furnishing the daily supply of the city. Hear how a private individual luxuriates in native fuel, free of cost. State Senator Lowry has a model well, from which pipes lead to every grate in the house, to the kitchen range, and to smaller pipes for chandeliers. In fire-places are laid the French imitations of wood, pierced with minute openings to permit the escape of gas, thus stimulating the cheerful blaze of the wood fire. An inch pipe supplies the unconsumable firewood, while a small bronze wheel regulates the supply by a turn. With fourteen fires burning, sixty gas lights in the house and grounds, the Senator lives in an atmosphere of perpetual summer. He even warms the cellar for the purpose of a laundry drying room. The only unpleasant thing about this wonderful supply is the question of permanence. This is hopeful, however, for the first well sunk for oil is in its seventh year, with an undiminished yield of gas, while in some cases, as at the Erie Car Works, the supply increases with time. The average depth of the Erie wells is 600 ft., and the cost about $1500; as each well yields from 10,000 to 30,000 ft. of gas per day, they generally repay their cost within three months. With the proximity of iron ore and facilities for receiving the ores of Lake Superior, Erie presents a splendid opportunity for the manufacture of iron with this fuel, free of cost. It is strange that, with the energy for which the place is noted, this has not been attempted. Iron should be made here for $12 per ton, if not less. Be this as it may, these wells certainly afford a most curious and gratifying evidence of Nature's bounty.—*Iron Age*, U.S.

IRON AND STEEL.—The invention of Mr. J. J. BODMER, Newport, consists, first, in the use of one or more hollow drums or cylinders rotating on horizontal axes, either intermittently or continuously within a furnace, their peripheries or circumferences being the working surface thereof, without or in conjunction with a stationary furnace bottom, for the purpose of puddling iron, of puddling steel, of melting iron, and of producing cast-steel. Second, in fettling drums or rollers on their peripheries or circumferences when used in the manufacture of iron or steel. Third, in the use of carrying rolls for the purpose of transferring from one surface to another either the charge or the fettling material, and the use of such rolls for the purpose of maintaining uniform distance of the drums for the puddling operation. Fourth, in working rolls at differential speeds and imparting to them a horizontal reciprocating motion in the direction of their length for the purpose of incorporating and amalgamating the materials composing the charge, and also for the purpose of causing the same to act as scrapers to their respective surfaces.

# IMPROVED VALVES FOR STEAM ENGINES.

FIG. 1.

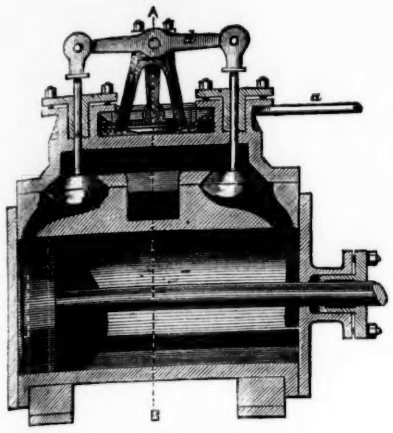



FIG. 2.

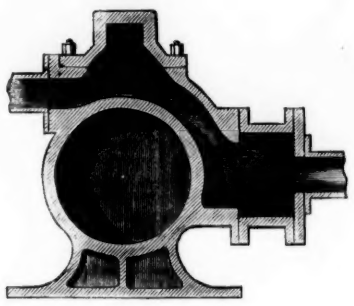


FIG. 3.

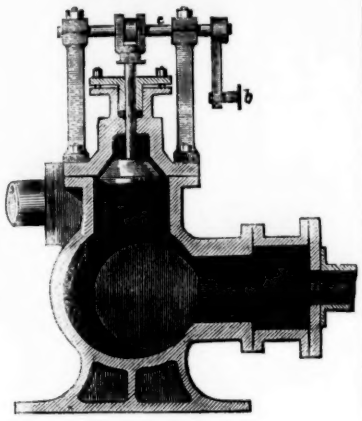



FIG. 4.

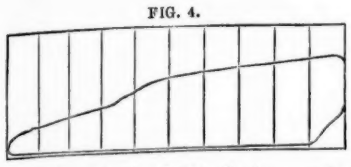


FIG. 5.

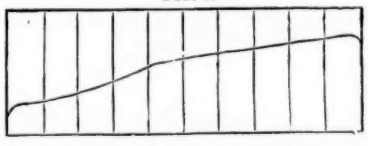
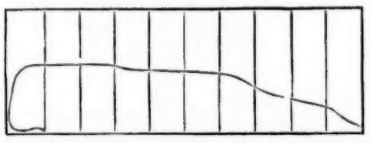


FIG. 6.



With a view to obviate the inconvenience of back pressure on the piston of high-pressure engines, Messrs. H. and T. JENNINGS, of Sidney-street, City-road, have invented a simple and ingenious arrangement in the shape of an auxiliary exhaust engine. A pair of single-beat puppet-valves, applied one at each end of the cylinder, communicate with extra waste ports, the usual slide-valve and its gear being in no way interfered with. The puppet-valves being fixed at opposite ends of a horizontal lever, the valve exposed to the greatest pressure will naturally keep closed and keep the other open, so that the instant steam is admitted to one end of the cylinder by the ordinary slide, the valve at that end will close under the pressure, and force open the other valve, the admission of steam at one side, or the augmentation of pressure by compression, thus ensuring under all circumstances the immediate release of the exhaust steam through a large port. But as there was much noise when the working of the puppet-valves depended upon the pressure of steam, Messrs. JENNINGS operate them by a separate eccentric, and thus overcome all difficulty. Adopting this principle, the slide-valve may be designed without regard to exhaust, and any desired amount of lead and lap can be used. Internal lap can be adopted to any degree, and the use of a single slide-valve in connection with considerable expansion rendered unobjectionable.

An engine of 10-horse power, with the improved appliances, has been built by Messrs. Horn, engineers, of Whitechapel, and works most satisfactorily, as may be judged of from the subjoined report of Mr. E. B. Barnard, C.E., which was made after minutely examining and testing the arrangement :—

*London, January*, 1871.—At your request I have tested your patent diaphram valves, now fitted to a 10-horse power engine at the works of Messrs. Horn Bros., engineers, Whitechapel, and beg to report as follows :—That in December last I took some indicated diagrams while the engine was under break power to test the value of the working of the valves only, and not with a view of testing any power of the engine, as will be seen by referring to the diagrams taken in sheet 1, where only an average pressure of 4·31 lbs. of steam was attained, and giving out on the fore and after end of piston a mean indicated horse-power of 3·44. It will be seen that all the diagrams are free from back pressure; but not being satisfied in my own mind that back pressure might not exist if the engine had a load or general work upon it, and being informed that it would shortly be put to drive the general machinery of Messrs. Horn's factory, I waited till such should be accomplished, in order that I might satisfy myself on that point by again testing the engine with more accuracy as to the efficiency of the action of your patent diaphragm valves. It may be as well to observe the size of engine:—A horizontal engine of the ordinary type; diameter of cylinder, 10 in.; length of stroke, 20 in.; diameter of fly-wheel, 8 ft.; diameter of driving-rigger. 4 ft. 11¼ in.; the rigger working two straps, one right the other left, driving the general work of the factory. It will be seen by referring to the diagrams in sheet 2, the speed varies from 52 to 68 revolutions per minute, with steam in the boiler from 37 to 40 pressure, but the engine was about 50 ft. from boiler, thereby allowing great condensation to take place, especially as the steam pipes were not felted or the cylinder lagged. In referring to the diagrams, Nos. 1, 2, and 3, sheet 2, it will be seen that the engine was working as an ordinary one without the diaphragm valves, and that a slight back pressure occurs, but immediately the diaphragm valves are set to work, under the control of the eccentric, that the back pressure is at once taken off, as will be seen by referring to the diagrams Nos. 4, 5, 6, 8, and 9; but in No. 7 the eccentric is taken off the valve lever, and the valves are worked by the exhaust only, which I cannot recommend, owing to a severe knock given to the valves, which in course of time must destroy the edges of same, as also their seating, and thereby cause leakage. The above remarks will also apply to the bottom side of piston, as will be seen by referring to the diagrams Nos. 1 to 7. It must be borne in mind that the eccentric which governs these valves must be set with the greatest care and nicety, or leakage will ensue. It will be seen by referring to the diagrams on the top and bottom of the piston, that the results are somewhat similar, although the horse-power differs; this, of course, can be only attributed to the lead of the steam valve, as cut off being slighly different from that of the top, as one bit, the top side, indicates 11·8-horse power, while the bottom side one indicates 9-horse power, giving a mean of 10·4-horse power. One fact, however, is established, that no back pressure exists when the diaphragm valves are worked, especially when under the control of the eccentric; it is well known that the back pressure of engines in general is a great loss of power, and hence a great consumption in coal. Another object in these valves is the prevention or carrying off surface or priming from the boiler, thereby relieving the cylinders instantaneously of water, and preventing damage to cylinders or pistons. It may be worth while also to note that should any slight leakage of piston occur no back pressure would take place, as it would be at once relieved by these valves. If the saving of coal, which must always be considered the primary object to all users of steam-power, it is my opinion that the expense in altering an engine to your principle is insignificant to the advantage gained. By referring to the annexed transverse and longitudinal sections of the cylinder and valves the whole matter is at once explained, and I am confident cannot but interest all parties using steam-power with a view to its economy. E. B. BARNARD, C.E.,
Surveyor of Machinery, &c.

N.B.—It will be seen by the above remarks that, in working under general circumstance, a back-pressure of 2 lbs. per square inch on the piston of this engine would be a loss of 10 per cent. on the power exerted.

Amongst the advantages claimed for Messrs. Jenning's invention are many of considerable importance. In cases of boiler priming or condensation of water in cylinder, it prevents the destruction of cylinders or pistons. With regard to their increased power and economy in coal, it is sufficient to refer to their preventing back pressure, since 2 lb. per square inch back pressure on area of piston produces in a 10-in. diameter by 20-in. stroke cylinder a saving of 10 per cent. on the power of the engine exerted. In condensing engines a much better vacuum is obtained through its greater extension, and as the invention can readily be applied to existing engines, there is nothing to prevent its very extensive adoption. There is, of course, a slight increase in the cost of construction of engines with the auxiliary valves, but this is considered to be much more than repaid by the greater efficiency and economy which result.

# DRESSING GOLD AND OTHER ORES—A NEW BUDDLE.

BY R. H. WILLIAMS, C.E.*

The chief improvements in this buddle over those already introduced are—

1.—That being supplied with a revolving tube, which regulates the supply of crushed ore, it is quite impossible to admit more water than is necessary to separate the ore, and, consequently, it is prevented from being washed back with the tailings.

2.—The revolving tube causes the direct fall of the ore to the cup in the centre of the buddle, which forms a self-regulating distributor of the ore all over the conical floor.

3.—The ore to be treated being submitted to a clear stream of water, in addition to the water necessary to hold it in suspension, the washing is much more effective, and the amount of separation at one operation is greater than in any process before invented.

4.—It is simple in construction, cheaply erected, and has no part that can decay, or that cannot in a few hours be replaced if worn or broken by accident.

To fix this buddle sink a pit about 3 ft. square, and a bout the same depth under the intended floor-line. In the bottom of the pit place some 2½ or 3 in. deal or oak plank. When quite level place the foot of the stand on the plank, and spike it down, taking care it is quite upright. Build in around the stand with masonry, as high as the floor-line; screw up the arm, and plumb from the centre to fix the cup; the bottom of the tube to be fixed about 16 in. above the top of the cup. Nail the cup down on a piece of wood exactly underneath the centre of the tube, from which take the pitch to the stand, and mark the outer line for the floor. Strike out the circumference from the centre of the cup, with a radius of 6 ft.

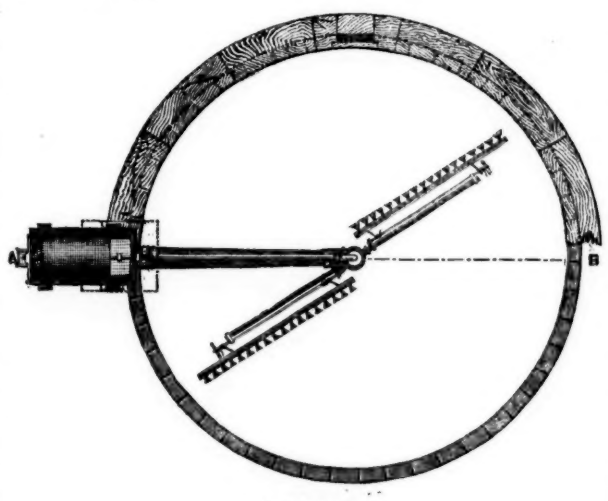
Construct the outside of the buddle 12 in. above the floor-line, marked as above stated. Lay in the bottom of wood, cement, or other durable material (Roman cement is best), taking care to have it perfectly conical, and that the outer part is exactly level all around. The pitch is calculated from the centre to the outer extremity of the buddle on a 6 ft. run.

For gold, silver, lead, tin, copper, or other ores, whose specific gravity allows of separation by washing, if stamped through a number 7, 8, or 9 grate, the amount of pitch or run should be 10½ in.; 10 or 11 grate, 9 in.; 12 or 13 grate, 7 in. For slimes, the first operation, have 3 in. pitch; for cleaning 4½ in. pitch. Some tin slimes require 6 in. pitch for cleaning. The tube must be driven about 4 revolutions per minute.

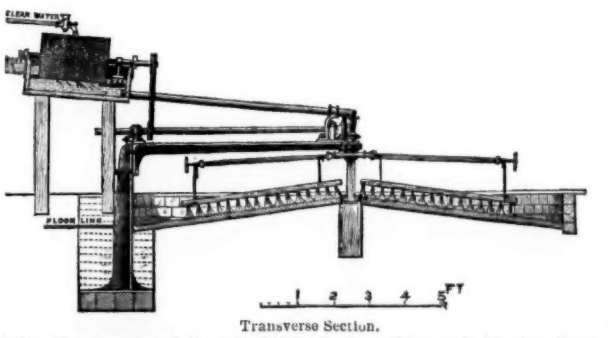
In the treatment of crop tin ores the buddles should have 10½ in. pitch; skimmings, coffer, or shaking trunkwork, 9 in.; slimes, first operation, 3 in.; cleaning, 4¾ to 5 in.

The hoppers or feeders must regularly supply the ore in suspension; and a constant stream of clean water must be kept up. The brushes must be always kept lowest toward the tail of the buddle; this can be done by occasionally taking off a turn of string over the end of the arm while the buddle is at work.

These buddles are in use in the Charlestown United Mines, St. Austell; and in Norway and Sweden, from 12 to 18 ft. in diameter.



Ground Plan.




Transverse Section.

They are especially valuable in dressing slime and cleaning tin ores—the last process for the market. In some instances half a pound of tin per ton of stuff has been extracted at a profit.

* From "Transactions of the Miners' Association of Cornwall and Devonshire."

## LONDON INTERNATIONAL EXHIBITION.

There are always so many details to arrange before any exhibit can be displayed to the best advantage that a visit to an international exhibition within the first few days of its opening frequently creates a much less favourable impression than would be produced a few weeks afterwards. The London International Exhibition of 1871 forms no exception to this rule; the exhibits are in a very incomplete state, and unless especial interest be taken in watching workmen putting machinery in working order, in admiring the ability with which carpenters can saw and plane wood, and in similar matters of practical industry, it will be better for visitors to defer their journey to South Kensington for at least a fortnight. Amongst the articles already on view of interest to the readers of the Journal, the Magnetic Lock Safety-Lamp of Messrs. CRAIG and BIDDER is, perhaps, entitled to the first mention. The invention has already been fully described, and is understood to be giving great satisfaction in the collieries in which it is employed.

An improved patent Winch, exhibited by Mr. ARTHUR PAGET, of Loughborough, attracted considerable attention. Its object is to adapt the power to the resistance, and for this it appears to answer admirably. It is explained that in most cases where a rope requires to be hauled on board a ship it will be found that the rope at first requires but little power to haul it in; it is, then, important that speed should be attainable, but as the rope is "got in" the power required usually becomes greater, and the speed must in consequence be reduced to obtain the required increase of power. This variation of power, or leverage, is not attainable in ordinary winches, but in this winch it will be seen that the radius, and consequent leverage, of the handle can, at pleasure, be varied by drawing out or pushing in the handle. On beginning to haul a rope the handle is at first used as pushed in to the shortest leverage, giving considerable speed in proportion to the power; and as the tension required to haul in the rope becomes greater the handle can be drawn out further, and thus more power can be obtained, until the handle has been drawn out to as great a length as a man can advantageously reach, as it is, of course, evident that at a certain length, usually about 20 to 23 in., no increase of power would be given to the operator by lengthening the handle, as when the handle was at the top a man would have very little power to push it over from him, but it will be seen that in this winch, when the handle has been drawn out to 20 in. radius, there is an arrangement of ratchets, or pawls, which enables the handle to be used as a reciprocating lever to lift the winch round step by step, and experiments show that this change from the handle rotating to reciprocating without any increase of length of handle at once increases the power of the operator more than fourfold, and it is, of course, evident that the length of the handle can be also increased to any desired extent when used as a reciprocating handle to lift the winch round, and thus very great leverage can be exercised to get the rope finally "taut," without losing the advantage of speed at the commencement of hauling the rope.

A Fluid Meter, equally adapted for the measurement of hot or cold liquids, is exhibited by the FLUID METER COMPANY, and is well worthy of careful examination, since it seems to be as efficient as it is simple. It is described as consisting of only one movable part, a circular disc, floating with perfect freedom on the liquid, so that there can be no possible friction. It is furnished with a ring of thumb-holes underneath, and rests, when the meter is not in use, on a lower plate, in which inclined inlet holes are bored, through which the water cannot pass without raising this disc, and cannot raise it without its revolving; therefore, in principle this meter is perfect. The two plates being in contact when the meter is at rest, absolutely prevents the return of the fluid which has passed through it and been registered. The absence of friction ensures unlimited durability, its simplicity ensures cheapness, and the perfection of the principle on which it works ensures accurate results. The practical value of the meter may be judged of from the fact that it has been highly approved by many engineers who have used it, whilst Mr. T. E. Bodkin, in a paper "On the Comparative Merits of Water Meters," read before the Society of Arts, stated that of more than 300 inventions which had come under his notice he considered it certainly the best.

The Vertical Shuttle Loom, manufactured by Messrs. CURTIS, PARR, and MADELEY, of Manchester, is recommended as a smallware loom, because it may be run at about double the ordinary speed, takes up very little space, requires little attention, and in consequence of the vertical position of the shuttles when in motion the wear thereof is very slight. The wraps, instead of being horizontal, as in the old loom, are arranged in a diagonal position, the angle being such that at the time when the shuttles are in motion they are in a vertical position. As the shuttles do not overhang the guides, and as the centre of gravity of each shuttle is, therefore, within the guides, the shuttles are moved with much greater ease than in the old looms, and the wear of the grooves in the shuttles is only a fraction of that which ordinarily takes place. The new loom is built in a durable manner, is neat and compact in design, and is self-acting in its motions for letting off the warps and taking up the woven fabric, thus dispensing with much of the attention required by the ordinary loom.

Bischoff's metallometer; tin-covered lead pipes by various inventors; Husband's atmospheric stamps; Galloway's pneumatic feed-pump; the improved process and furnaces for roasting ores, and for the recovery of sulphur from alkali waste, invented by Messrs. Helbig and Hasenclever and Mr. L. Mond; and many other inventions with which the readers of the Journal are familiar, will be referred to next week.

The New South Wales collection, although far from complete at present, in consequence of the loss of one cargo of deposits, and the non-arrival of another, contains much that is worth examining. During the past few years much has been written in the Journal concerning the kerosene oils of the colony, and no doubt is entertained that the manufacture of these will be developed into a very important industry. The very fine samples of the shales from which the oils are made appear fully to justify this opinion, since they contain a large percentage of oil, and evidently occur in thick deposits. The drawings showing Miller's process of gold refining by chlorine gas, used in the London and Sydney Mints, should also be inspected, as they greatly facilitate the comprehension of the details; and as every exhibit appears to the best advantage through the readiness with which the Commissioner, Mr. Sedgwick Cowper, supplies all necessary information, it will be found that these are not the only articles that will prove attractive.

There is, for instance, an excellent hand Anemometer, invented by Mr. H. C. RUSSELL, of the Sydney Observatory, which is likely to come largely into use. It consists of a set of Robinson's cups, mounted on a light steel spindle, made to work as freely as possible, a dial-wheel which indicates the quantity of wind measured, and a two-minutes sand-glass, ingeniously mounted, so that a slight motion of the finger instantly inverts it. This instrument was designed expressly for use in the hand, and to meet a want that has been long felt by observers. A cheap and effective instrument for the register either of the velocity or of force, so as to be entirely independent of estimations. Two things were deemed essential in the instrument—"trustworthiness" and "cheapness." The first was ensured by adopting Robinson's cups, which are now acknowledged by scientific men to be the best for anemometers. The second, by making it as simple as possible, and having machines to make the several parts, so that uniform results might be readily obtained. A long series of experiments has shown that the instrument is perfectly trustworthy, and that the results obtained are comparable with those from larger instruments on the same principle. In ordinary cases holding the instrument in the hand for two minutes will give the force of the wind, but if the observer wishes to measure the force of a gust lasting only a few seconds he can do so by noting the number of hundredths of a mile recorded, and the number of seconds the gust lasts, then multiply the hundredths recorded by 36, and divide by the number of seconds. Suppose, for example, he holds it up for six seconds, and it records seven hundredths, then 7 by 36, divided by 6=42 miles per hour. This is stated to be the only instrument ever offered to the public suitable for ships' use, and the inventor feels confident that it only needs a trial to convince captains of its utility. By its use the actual velocity of the wind may be measured, and entered daily in the ship's log. The velocity of wind in gales may be accurately measured, and a result so obtained will be extremely valuable to science as well as commerce. To all who take an interest in meteorology this instruments offers the most convenient, and at the same time the cheapest and most satisfactory, way of determining the force of the wind. It is not, of course, intended to take the place of fixed instruments on the same principle, but these are so expensive that few are sold, and their only advantage is that they give the total number of miles for the day, a result which by a few well chosen experiments may be very nearly obtained by this cheap instrument, while the convenience of being able at any time to determine exactly the force of the wind will only excite wonder that a similar instrument has not been offered to the public before.

GEOLOGISTS' ASSOCIATION.—A numerous party of the Geologists' Association visited Belvedere on Saturday last, for the purpose of inspecting the fine collection of mammalian remains in the possession of Mr. F. C. J. Spurrell, F.G.S. The party was accompanied by Prof. Morris, who described the contents of the museum in his usual happy manner. Almost all the specimens in Mr. Spurrell's collection have been obtained from the Pleistocene Thames Valley deposits of the immediate neighbourhood of Erith and Crayford. When, therefore, we find in this museum the remains of lion, of bear, of hyena, of three species of elephant, of two species of rhinoceros, of horse, and of other quadrupeds, we are very forcibly reminded of the abundance of the larger animals, both carnivora and herbivora, with which the country surrounding the great city was peopled in pre-historic times. This collection is interesting, moreover, on account of the evidence it affords of great climatic alterations, for here we see bones of species which flourish in warm climates, and of others which inhabit northern regions. The lion of the tropics and the musk ox of the Arctic zone have both left traces of their existence on the banks of the Thames. Mammalian remains are not, however, the only records of the past which the deposits of the Thames Valley yield to the searcher for the "medals of creation." Many species of mollusca which are now living in England have been found fossil in this locality, and a species of Cyrena, *Cyrena fluminalis*, not now living in the British area, but found flourishing at the present time in the River Nile. Additional interest is given to this part of Kent by the existence of numerous caves, or excavations, in the chalk. These curious and obscure cavities are locally termed *Grimes' Graves*, and are just now attracting considerable attention on account of the investigations in progress with the object of ascertaining their history. They are evi-

dently the work of man, and it is not improbable that they were excavated for the purpose of obtaining from the chalk those flints which were of such great use and value to our pre-historic ancestors.

## ON THE MINERALS OF STRONTIAN, ARGYLLSHIRE.

At the Geological Society meeting, on April 26, the Rev. ROBERT H. SCOTT, F.R.S., in a paper on this subject, stated that the existing lists of minerals to be found at Strontian were incorrect. The discovery of apophyllite, talc, and zircon, seemed to be hardly sufficiently confirmed. On the other hand, Mr. Scott named several species which he had himself observed *in situ*, and which are not noticed in any of the books—viz., two felspars, orthoclase, and an anorthic felspar in the granite. Two varieties of pyroxenic minerals in the granites and syenites, neither of which have as yet been analysed. Natrolite in the trap dykes, muscovite or margarodite in very large plates, lepidomelane, and schorl. Specimens of these minerals and of the others found at the mines were exhibited; but it was stated that, owing to the fact that the old workings at the mines in Glen Strontian had been allowed to fall in, it was now no longer possible to ascertain much about the association of the species. The one is galena, containing very little silver. The gangue is remarkable for the absence of fluor and the comparative rarity of blende and heavy spar. Harmotome is found principally at a mine called Bell's Grove, both in the opaque variety and in the clear one called morvenite. Brewsterite occurs at the mine called Middle Shap, and at the mine Whitesmith strontianite is found with brewsterite, but without harmotome. Calcite is also very common. Within the last few years a new mine has been opened called Corrantee, which is in the gneiss, whereas the other mines lie on the junction of the granite and gneiss. At this mine several fine specimens of calcite have occurred, many of them coated with twin crystals of harmotome, similar to those from Andreasberg, whereas the crystals found at the old mine are not so clearly marked. Associated with these were found a number of small hexagonal prisms, perfectly clear, and exhibiting a very obtuse dihedral termination, They gave the blowpipe reaction of harmotome; and on analysis by Dr. J. E. Reynolds, proved to be that mineral. Descloiseaux has already described a quadrifacial termination to harmotome, with an angle of 178° 20'. Mr. Scott submitted that possibly the crystals which he exhibited might bear faces which had a close relation to those described by Descloiseaux. He concluded by stating than Strontian promised as rich a harvest to the mineralogist as any locality in these islands.

Mr. W. W. SMYTH mentioned the wonderful collection of minerals from Strontian which had been brought to the Great Exhibition of 1861, which gave a most striking idea of the mineral riches of the locality. The occurrence of such a series of different substances in one locality in the granite was almost unparalleled, though in the Andreasberg Mines, in clay-slate, they were to some extent rivalled. The features, however, differed in the two places, more silver and a greater number of zeolites being present in the Hartz mines.

Mr. D. FORBES observed that harmotome occurred also at the Kongsberg silver mines, in Norway, at a distance from granite. He thought it remarkable that these crystals of peculiar form occurred in the same spot, and in connection with crystals of the same substance, but of the ordinary form.

Mr. DAVIS remarked that celestine was also to be placed on the list of the minerals from Strontian. Harmotome had been found in the same form of double crystals at Bodenwies, in Bavaria.

Mr. SCOTT stated, in reply to a question from the Chairman, that the mineral had not been as yet optically examined, but that if he could procure more of it he should be happy to place it at the disposal of any gentleman who would examine it. As regarded the idea that harmotome usually occurred near the surface, he could give no information about the old mines, as they had been allowed to fall in; but most certainly the new specimens from Corrantee came from surface workings. He was very glad to learn from Mr. Davis that celestine had been found in the locality; and he felt sure that careful search would double or treble the number of species known to occur there. With reference to what had fallen from Prof. Smyth, he could fully corroborate his observations as to the difference between the forms of calcite associated with harmotome at Andreasberg, in the Hartz, and at Strontian. It was remarkable that the general facies of the crystals of calcite occurring at Corrantee, where the lode was entirely in the gneiss, differed from that usually observed in the old mines in Glen Strontian, which were partly in the granite and partly in the gneiss.

## STEAM-POWER METER AND INDICATOR.

At the Institution of Mechanical Engineers general meeting, held on April 27th, in the Lecture Theatre of the Midland Institute, Birmingham, a paper was read "On Ashton and Storey's Steam-Power Meter and Continuous Indicator for Steam-Engines," by Mr. JOHN H. STOREY, of Manchester. The only method hitherto available for ascertaining the power developed by steam-engines, in cases where the work is subject to variation, has been by means of isolated indications, obtained at intervals by the ordinary steam-engine indicator, which have then been taken as averages for calculating the whole work done. The continuous indicator described in the paper possesses the advantages of not only measuring the power developed during a single stroke of the engine with as much exactness as the ordinary indicator, and also of registering this power as exactly as it is measured; but what is of much more consequence, the measurement and registration are effected continuously for the whole number of strokes made by the engine during the entire period of work, whatever variation may occur between the individual strokes. The instrument thus shows at all times the measure of the power developed by the engine to which it is applied, and registers the aggregate of the power during any required period. It consists of a cylinder and piston, like those of an ordinary indicator, but having each end of the cylinder connected by a separate pipe to the corresponding end of the engine cylinder. The piston-rod of the instrument is attached at top to the ordinary spiral indicator-spring, which is compressed or extended by the upward or downward movement of the piston; and the rod also carries a long pinion, turning loose upon it between fixed collars, which gears into a train of wheel-work moving an index upon a dial. Fixed to the pinion on the piston-rod is a plain wheel, called the integrating wheel, having a rounded edge, which is in contact with the face of a flat disc mounted upon a horizontal shaft, the disc face being held against the edge of the wheel by the pressure of a light spring at the end of the shaft. The movement of some reciprocating part of the engine is communicated either by a cord or by gearing to the disc-shaft, causing the disc to rotate alternately in opposite directions; and the integrating wheel receives from the disc a rotary movement, the amount of which is proportionate to the distance of the point of contact of the wheel with the disc, above or below the centre of the disc. Thus in the upstroke of the engine, with the steam acting underneath the engine piston, and also the indicator piston, the integrating wheel is caused to traverse upwards, above the centre of the disc, to a height proportionate at every point of the stroke to the varying effective steam pressure under the piston; the amount of rotation which it receives from the revolving disc is, therefore, proportionate to the amount of the effective pressure—that is, to the power exerted by the engine, at every part of the stroke; and the index driven from the integrating wheel records on the dial in foot-pounds the total amount of the power exerted througout the up-stroke. In the succeeding downstroke the disc is driven by the engine in the contrary direction; but as the integrating wheel is then caused to traverse downwards, below the centre of the disc, by the steam pressure acting at that time above the piston, the wheel is still made to rotate in the same direction as before; and thus the record of the power developed in the downstroke is added on by the index to that in the preceding upstroke. The indication upon the dial is accordingly continuous for the successive strokes of the engine; and the power indicated is the net amount of power corresponding to the work actually done. A second dial and index can be arranged for showing at any time the actual horse-power of the engine, with any particular diameter of cylinder, by simply noting the extent of movement of the index during the period of one minute. An ordinary revolving barrel for taking indicator diagrams in the usual manner can also be added to the instrument, the communication being then temporarily closed between the engine cylinder and one end of the indicator cylinder, in order that the diagram may show both the steam pressure and the back pressure of the vacuum or exhaust. Several of these meters are now in use, some of which have been applied to marine engines and to rolling-mill engines; and in such cases where the power required to be exerted by the engine is subject to great variations continuous indication affords the only means of ascertaining correctly the actual power developed. Specimens were exhibited of the indicator, showing its mode of action; and instances were given of its application, with the results thereby ascertained in the working of the engines to which it has been applied.

## IMPROVED BLAST-FURNACES.

Mr. BERNHARD SAMUELSON, M.P., C.E., read a paper at the Institution of Civil Engineers, on Tuesday, descriptive of two Blast-Furnaces erected in 1870 at Newport, near Middlesborough. The author having called attention to the enormous development in the production of crude iron during the last thirty years, now four times as great as in 1840, and having shown that it had increased three hundredfold since 1750, at which time the whole annual produce of the United Kingdom was only equal to two-thirds of that of a single modern blast-furnace, proceeded to describe the general arrangements of a furnace plant recently erected under his direction, and for his account, by Mr. Richard Howson, the resident engineer of the Newport works. The ironstone smelted was the ordinary argillaceous ore from the lias, containing, when dried, from 33 to 40 per cent. of protoxide of iron, and from 2 to 7 per cent. of sesquioxide of iron, equal to from 26 to 33 per cent. of metallic iron (increased by calcination to from 37 to 40 per cent.), and of from 20 to 25 per cent. of carbonic acid, 10 to 15 per cent. of silica, 10 to 15 per cent. of alumina, 1 to 1½ per cent. of phosphoric acid, in addition to 8 to 12 per cent. of magnesia and lime. The fuel was the hard coke of South Durham; the flux principally mountain limestone.

Whereas in three furnaces erected by him in 1854 for smelting the same ore the quantity of fuel required to produce 1 ton of pig-iron varied from 32 to 40 cwts., and in five furnaces erected in 1863-4 from 23 to 24 cwts., the coke consumed in these new furnaces was only 20·35 cwts. This great economy of fuel was due, first, to greater capacity, augmented from 5000 cubic feet in the earlier furnaces to 16,000 cubic feet in those next erected, and to 30,000 cubic feet in those forming the subject of this paper. Secondly, to increased temperature of blast at the tuyeres, which had been increased from 650° in the earlier to 1100° in the later furnaces; and lastly, to increased regularity in working, the result of improvements of construction, all aiming at the greatest attainable simplicity and solidity. Drawings were shown exhibiting the relative sizes and the internal forms of the three types. The produce of pig-iron from one of the latest furnaces was stated to be from 490 to 500 tons per week.

The works were so arranged that all the raw materials entered at one end, whilst the iron produced and the mineral trucks, when empty, left at the opposite end, both being connected with the main line of the Stockton and Darlington Railway; and the western end also, with a wharf on the River Tees, forming part of the works, at which vessels of from 600 to 800 tons were loaded.

The trucks in their passage through the works were raised by a steam-lift consisting of an inverted cylinder, 40 ft. long, and 38 in. in diameter, erected upon columns, from the piston of which a rod descended, and was attached to the lift by a cross head. The average gross weight of the trucks to be lifted was 14 tons; when they reached the top they were run on to a high-level railway, which traversed a series of five calcining kilns and three boxes or bunkers for holding coke and small coal. The ironstone and limestone, and a sufficient quantity of coal for calcining, were discharged into the kilns, whilst the coke for the blast-furnaces and a store of coal for calcining, were dropped into the boxes. These boxes, like the trucks, were furnished with movable doors at the bottom, and discharged themselves without manual labour, except that of opening the doors. After the trucks were discharged they descended by means of a drop, consisting of a platform, overbalanced by counterweights, so as to keep it at the upper level until the balance was inclined in the other sense by the weight of a truck. The descent of the drop was controlled by a friction break.

The kilns were cylindrical, built up of wrought-iron plates, and lined with fire-brick. The bottom was tapered, and had openings all round for the admission of air and the withdrawal of the calcined stone, which was directed to the openings by a central cone, having its apex upwards. Each kiln had a capacity of 15,800 cubic feet, and held 630 tons of ironstone and limestone.

From the kiln and bunkers the materials were carried in barrows to the furnace hoist. The entire lift was 92 feet. The author considered this hoist as the simplest and most economical which had yet been constructed. It consisted of a main spur-wheel, 12 feet in diameter, erected on the platform connecting the two furnaces at the top, each side of the wheel being flanked by a grooved pulley, carrying a steel rope 1¼ inch in diameter. From opposite ends of these ropes two cages were suspended, which balanced each other, and were guided by the columns supporting the platforms. The ropes passed only half round the pulleys, and were driven by their friction on the latter, so that whenever one platform touched the ground, the weight being removed, the other could not be overwound. Motion was given to the spur-wheel and pulleys by a train of wheels connected with an 8-in. double cylinder engine, also erected on the furnace platform. Steam was conveyed to these engines from the boilers by a pipe 200 feet in length, but, being well covered, the loss by condensation was only trifling.

The foundation of the blast-furnaces was brickwork, resting on clay; on this a circular base of solid brickwork, 7 feet in diameter, was erected, having a stone curb, on which were the columns, 18 ft. 6 in. high, which carried the upper part of the furnace, the lower part being supported partly by a wrought-iron conical case, and partly by the brickwork and stanchions which surrounded the hearth. From the tuyeres upwards the furnaces were cased with wrought-iron plates, varying from ⅜ in. to ½ in. in thickness. The interior was lined with fire-brick lumps, 5 in. thick, backed with ordinary fire-bricks. The lumps forming the bottom of the hearth, which was 4 ft. 6 in. in thickness, consisted of two courses set on edge, and breaking joint. These lumps, as well as those forming the lining to within a short distance above the tuyeres, were chisel-dressed on both faces and joints. The principal dimensions of the furnaces were:—Diameter of hearth, 8 ft.; diameter at the bosh, 28 ft.; total height from hearth to platform, 85 ft.; depth of hearth at tuyeres (four in number), 3 ft. 6 in.; diameter of bell opening, 13 ft.; and cubical capacity, 30,085 ft.

The peculiar construction of the bell and hopper, an ingenious invention of Mr. Wrightson, of Stockton-on-Tees, was next described. The apparatus was used for charging the furnace, and for closing its top, except when it had been opened for that purpose. All the waste gases were thus stored, conveyed by descending tubes to a main culvert, and thence by passages to the boilers and hot-air stoves, where they met with the requisite proportion of atmospheric air for combustion, and served instead of coal to raise steam and heat the blast. The temperature of these gases at the furnace-top was stated as varying between 315° when a charge of cold materials was first introduced, up to 634° before the next charge. The various valves for regulating the admission of gas and air to the boilers and heating stoves, and for insuring their proper admixture, were shown and described.

The heating stoves consisted of nine sections to each furnace, of which eight were always in use, and a ninth cooling or being cleaned. The cast-iron heating pipes were U-shaped in elevation, and oblong in cross section. There were twelve in each section, and their internal heating surface per furnace was about 10,000 square feet. The air entered them from a cold-blast main by valves, and was discharged into the hot-blast main, which latter was lined with fire-brick 14 in. thick, to prevent radiation. From the hot-blast main the air passed to the tuyeres, and entered the furnace at a pressure of 3¾ lbs. above that of the atmosphere.

The four blowing-engines, coupled in two pairs, which furnished 8000 cubic feet of air to each furnace, condensed to a pressure of 4½ lbs. per square inch above that of the atmosphere, were of the vertical construction, now almost universal in Cleveland. The diameter of the steam cylinders, which were placed immediately over the blowing cylinders, was 32 in.; that of the blowing cylinders was 66 in. the stroke of both being 4 feet. The number of revolutions per minute was 24; and the steam pressure, cut off at a fourth of the stroke, was 55 lbs. The steam was supplied to these engines, to the donkey-engines which pumped water for the tuyeres and the boilers, and to the hoist and kiln-lift, by seven Cornish boilers, 5 ft. 6 in. in diameter, and 35 ft. long, an eighth boiler being always kept in reserve.

For the transport of the materials of these two furnaces and the removal of the slag two locomotives were required; the latter had wheels only 2 ft. 6 in. in diameter, and 5 ft. from centre to centre, in order to pass readily round curves of small radius.

The entire cost of the works, of which full details were given, was 56,331*l.* 4s. 4d., exclusive of land. The principal contractors were, for fire-lumps, Messrs. William Stephenson and Son, of Throckley Works; for the heating stove-pipes, Messrs. Smith and Thomson, of Stockton; for the boilers, hot-air valves, &c., Messrs. Cochrane and Grove, of Middlesborough; for the blowing-engines, Mr. John Stevenson, of Preston; for the gantry lift cylinder and slagging engine, Mr. Martin Samuelson, Hull.

The author refrained from entering into the questions of the various reactions in the blast-furnace, the relative amount of economy due to capacity of furnace and temperature of blast, or the merits of the regenerative heating-stoves of Messrs. Cowper and Siemens, and of Mr. Whitwell, as compared with the cast-iron pipe-stove adopted by himself, those subjects having been already treated by Mr. Cowper, M. Inst. C.E., Mr. Isaac L. Bell, Assoc. Inst. C.E., and Mr. Charles Cochrane; but he presented the works described as an example of a plant fully equal to the standard of the present day, and in which no pains had been spared to combine the two great essentials in the construction of ironworks—durability and simplicity.

## SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE INSTITUTE OF MINING ENGINEERS.

An ordinary monthly meeting of members was held on Monday, in the Museum, Dudley, Mr. J. COOKSEY, the President, in the chair. The following gentlemen were also present:—Messrs. Checkley (Vice-president, Henry Johnson (hon. sec.), S. B. Ensell, W. Spruce, D. Peacock, G. Spruce, G. Taylor, T. Oakes, J. M. Fellows, J. Lindop, J. Williamson, J. Lawley, J. Gethin, S. Bate, T. Williams, T. Lloyd, W. H. Hall, J. Hughes, and R. Mason. Mr. William Evans, mining engineer, Bloxwich, was proposed as an ordinary member.

Mr. JOHN WILLIAMSON, of Cannock and Rugely Colliery, introduced to the meeting a model of a cage, with safety apparatus, by Mr. James Bailey, a working collier. Mr. Williamson pointed out that the safety was to be obtained by leverage. If the rope broke whilst the cage was ascending or descending the shaft, the weight of the cage was sufficient to act on the apparatus above, and cause constant compression on the guides. The idea was a novel one to him, and he thought by simplifying it a little a valuable improvement might be effected, and thus prevent many fatal accidents. (Hear, hear.) Several members examined the model, and pronounced it an ingenious contrivance. Mr. Williamson then read a paper "On a New Ventilating Door," and exhibited a model of one fixed in his pits at Cannock and Rugeley Colliery. The principle of the door was the "rising hinge," adapted for the purpose. The reader said the doors might be blown open further than 90, and they would close again of their own accord, thereby preventing fatal accidents. There was further a vast saving by the use of the doors, inasmuch as they might easily be reversed by changing the hinges from one side of the frame to the other. Previous to the adoption of the door in his pit it cost, when they wished to change the current of air, 4s. 6d. for displacing each door. All that was saved by the new principle. (Hear, hear). Mr. Williamsom then exhibited a measuring chain, which he found extremely useful. At the distance of each 10 yards were two brass links in place of the ordinary iron or steel ones, and a label with the number of yards from each end of the chain upon it. Thus, on the first label were the figures 10-90, at the second, 20-80, and so on. The chain was examined and admired by the members. It was considered a vast improvement on the old one, especially in the introduction of the brass links, which were readily found. The exhibitor said the price was only a trifle above the ordinary chain.

Mr. W. E. TEALE (Manchester) exhibited a patent safety-lamp. He said it was almost impossible to prevent colliers tampering with their lamps in order to obtain a light. They found keys for the very best locks which could be invented, and they deranged others so that they became powerless to protect the flame from the tamperer. Under these circumstances, he had turned his attention to the discovery of a lamp which should prevent the collier obtaining a light from his lamp. A volatile oil was to be burnt in order that a clear, steady flame might be secured. Mr. Teale then put his lamp in order, and submitted it to the meeting. The flame burnt brightly and steadily, but the moment an attempt was made to unscrew the bottom the light began to decrease, and by the time the operation was half performed the light had gone out. This was effected by the raising of an extinguisher by the action of unscrewing. The exhibitor claimed for his lamp safety, non-exposure of flame, twice the usual light, economy in burning, absence of soot, and little trouble. The members present experimented in various ways with the lamp, and finally expressed their satisfaction with it.

The VICE-PRESIDENT proposed a vote of thanks to Mr. Williamson, to Mr. Bailey, and to Mr. Teale, and this was seconded by Mr. LINDOP.—Mr. BAILEY, in reply, said he was grateful to the members for the suggestions they had made as to the simplification of his model, and he would try to profit by them. (Applause.)—Mr. TEALE, in reply, promised to leave a lamp with the institute. (Hear, hear.)—The PRESIDENT, addressing Mr. Bailey, said the institute would have the greatest possible pleasure in assisting him in every way with his invention if he brought it out on a practical scale.

## DINNER AND PRESENTATION TO MR. WILLIS, HER MAJESTY'S INSPECTOR OF MINES.

On the death of the late Mr. Atkinson, Her Majesty's Inspector of Mines, Mr. Willis, of Washington Colliery, was nominated to the important vacancy. In the course of six years' supervision of the interests of Washington Colliery Mr. Willis had endeared himself to all with whom he came into contact, and the good feeling existing took shape in a dinner and presentation, which was held on Saturday evening, at Mr. Robinson Todd's Cross Keys Inn, Washington. There was an excellent muster. The chair was occupied by the Rev. T. Thackeray, of Usworth, and the vice-chair by Mr. George Forster, Washington. Among those present were—Messrs. S. B. Coxon, Usworth Hall; Henry Coxon, Newcastle; Dr. Jones, Washington; J. A. Ramsay, Washington; John S. Nicholson, J. Newby, J. Marley, J. Coxon, G. W. Wilkinson, J. Robinson, R. Johnson, J. Willis, W. Cordner, Smith Charlton, Bowdon, &c.

An excellent dinner having received ample justice, the usual loyal and other toasts were given and responded to.

Mr. S. B. COXON, on rising to propose the toast of the evening, was received with much cheering. He said he was utterly at a loss to define the reason why he had been selected by the Committee to propose the toast, unless it were the warm feeling of personal respect and appreciation which he was known to entertain for the guest of the evening. (Cheers.) So well known and generally appreciated was Mr. Willis that it required no effort on his part to arouse their feeling or excite their enthusiasm. (Applause.) Mr. Willis had been among them for many years, and he had rendered many services to the community of Washington. (Cheers.) They all knew how he had laboured to elevate the moral tone of those around him, and how well he had managed the vast interests entrusted to his care. (Loud cheers.) They had, indeed always looked to him as sort of head-centre—(laughter and applause)—and when he parted from them he would leave a hiatus which it would be difficult to fill. (Hear, hear.) In many instances of danger he (Mr. Coxon) had had the benefit of Mr. Willis's experience, and he took that opportunity of thanking him. (Applause.) He had enjoyed no little of their guest's society since he came amongst them, and indeed, the moments of their intercourse seemed sunny and winged, and long to be remembered. (Cheers.) In directing Mr. Willis's attention to the articles which constituted the presentation—a handsome clock, and a stately set of mantle-piece ornaments—Mr. Coxon said that when the guest of the evening had been called by the Government to exercise the functions of an Inspector of Mines, the warm hearts and firm friends of Washington determined respectfully to offer for acceptance the testimonial which in their name he now presented. (Cheers.) While asking Mr. Willis's acceptance of the testimonial, he called upon the company to fill their glasses to the "beaded brim," in honour of Mr. Willis, Her Majesty's Inspector of Mines. (The toast was drank with musical honours.)

Mr. WILLIS, on rising to respond, was received with deafening cheers. He wished either to be nine feet high or as handsome as his valued friend to the right—(laughter)—in order to do justice to the ovation of which he had been the subject. (Cheers.) Why he had been considered worthy of such an ovation he did not know. It seemed to him but a short time since he had come amongst them, and that he had done nothing beyod his duty, but the presence of so many there to bid him good-bye was evidence to him that he must in some way have won their esteem. (Cheers.) He had never been so foolish as to fancy he could make a speech. He had to ask their indulgence to accept thanks without their formal expression. The coal trade was in a peculiar position when he first came amongst them. Then there were differences between the employers and employed. These had been done away with, and no one had contributed more to that result than his excellent friend on the right—Mr. Coxon. (Loud cheers.) He (Mr. Willis) had always been glad to follow in Mr. Coxon's footsteps. (Hear, hear.) He had always found much pleasure in following Mr. Coxon's example, and he had also found it good policy. (Applause.) He must speak of that as a difficult neighbourhood in the matter of mining. They had, nevertheless, been wonderfully free of disasters or large accidents, and they had the authority of a gentleman to whose judgment all deferred—namely, Mr. George Elliot—(cheers)—that a person who could manage such pits as Usworth, Washington, and Springwell, must know something of the difficulties of mining. There were difficulties, and when he was beset by such he would not hesitate to seek Mr. Coxon's advice, for he was sure it would be freely given. After referring to the duties imposed upon him by the appointment of Government Inspector, Mr. Willis expressed his wish to conduct himself in a kindly, friendly spirit, and as a gentleman—as one whose visit was wished instead of being dreaded. (Cheers.) He would at all times be willing to give

such advice as he possessed, and so far as Washington was concerned, he hoped in after years to find his friends unchanged, as he hoped and believed there would be no change in him. (Cheers.) He gave the health of his successor, Mr. Ramsay, whom he eulogised warmly.

Mr. RAMSAY, in responding, said it had been his lot to travel through nearly every country in Europe, and wherever he went he found Durham and Northumberland spoken of not only as the coal counties of England, but as the great school from which mining engineers were sought for all parts of the world. (Hear, hear.) They might talk of the continental system of technical education as they liked, but with all their old established, old fashioned academies, the foreigner had nothing to equal that now provided for every Englishman. (Hear, hear, and cheers.)——The usual complimentary toasts succeeded, when the meeting—a most enjoyable one—broke up.

## SALES OF COPPER ORES.

### COPPER ORES SOLD AT THE CORNWALL TICKETINGS, FOR THE QUARTER ENDING MARCH, 1871:—

| Mines. | Tons. | Amount. |
|---|---|---|
| Devon Great Consols | 4421 | £12,948 18 6 |
| South Caradon | 1499 | 9,348 6 6 |
| Marke Valley | 1440 | 5,168 9 0 |
| West Seton | 685 | 3,507 11 0 |
| East Caradon | 611 | 2,761 2 0 |
| Brookwood | 584 | 2,420 2 6 |
| Wheal Friendship | 402 | 2,366 2 6 |
| Gunnislake (Clitters) | 410 | 1,860 8 6 |
| New Pembroke | 240 | 1,670 14 0 |
| East Pool | 521 | 1,580 8 6 |
| West Tolgus | 575 | 1,531 3 6 |
| West Seton | 395 | 1,467 12 6 |
| West Basset | 275 | 1,428 10 0 |
| West Maria and Fortescue | 470 | 1,421 15 0 |
| Prince of Wales | 287 | 1,256 7 6 |
| Phœnix | 286 | 1,188 17 0 |
| Wheal Seton, &c. | 268 | 1,092 11 0 |
| South Frances | 207 | 1,033 6 0 |
| North Treskerby | 188 | 1,009 6 0 |
| Carn Brea | 254 | 1,006 5 6 |
| Glasgow Caradon | 226 | 984 13 0 |
| West Caradon | 241 | 968 17 6 |
| East Grenville | 275 | 928 8 6 |
| Wheal Russell | 163 | 828 0 0 |
| Virtuous Lady | 104 | 737 4 0 |
| North Crofty | 104 | 652 12 0 |
| West Damsel | 187 | 622 12 6 |
| Crenver and Abraham | 220 | 582 9 0 |
| North Downs | 105 | 571 4 6 |
| Kelly Bray | 260 | 564 0 0 |
| South Crofty | 237 | 543 4 6 |
| Poldice | 140 | 518 13 0 |
| Mellanear | 94 | 514 15 0 |
| Craddock Moor | 101 | 501 1 0 |
| South Crofty | 217 | 490 5 6 |
| Gawton | 150 | 432 5 0 |
| Treffry's Regulus | 32 | 423 14 6 |
| Bedford United | 120 | 389 15 0 |
| Wheal Basset | 71 | 376 4 6 |
| East Seton | 62 | 367 7 0 |
| East Pool | 140 | 356 7 0 |
| Levant | 30 | 291 1 6 |
| Wheal Crebor | 86 | 282 10 0 |
| Wheal Buller | 22 | 252 9 6 |
| Carn Camborne | 100 | 252 7 6 |
| Gonamena | 72 | 241 0 0 |
| East Carn Brea | 52 | 213 9 0 |
| Champion's Ore | 31 | 144 18 6 |
| Devon and Cornwall | 47 | 137 9 6 |
| Wheal Crelake | 64 | 136 0 0 |
| Wheal Jewell | 35 | 125 6 6 |
| Copper Hill | 21 | 119 14 0 |
| Clifford Amalgamated | 43 | 110 13 6 |
| Okel Tor | 53 | 102 0 6 |
| Boscaswell | 3 | 99 3 0 |
| South Carn Brea | 22 | 61 0 0 |
| Dolcoath | 18 | 59 17 0 |
| Franco Consols | 35 | 58 12 6 |
| North Pool | 13 | 56 17 6 |
| Phillips's Ore | 13 | 52 19 6 |
| Pennance | 24 | 49 16 0 |
| East Basset | 12 | 49 13 0 |
| Emily Henrietta | 9 | 38 14 0 |
| North Roskear | 5 | 27 5 0 |
| Mitchell's Ore | 9 | 24 19 6 |
| South Dolcoath | 7 | 23 16 0 |
| Pendarves United | 6 | 18 0 0 |
| Pendeen Consols | 2 | 17 3 0 |
| Jewell's Ore | 3 | 12 0 0 |
| Tremillian's Ore | 3 | 9 4 6 |
| COMPANIES BY WHOM THE ORES WERE PURCHASED:— | | |
| Vivian and Sons | 3880 | £13,858 11 7 |
| P. Grenfell and Sons | 2404 | 14,188 16 2 |
| Sims, Willyams, and Co. | 1074 | 6,145 8 10 |
| Willyams, Foster, and Co. | 3535 | 14,352 11 8 |
| Mason and Elkington | 2586 | 10,116 12 10 |
| Copper Miners' Company | 1146 | 4,003 16 6 |
| Charles Lambert | 989 | 1,672 10 0 |
| Newton, Keates, and Co. | 309 | 1,418 5 5 |
| Sweetland, Tuttle, and Co. | 1774 | 5,722 17 6 |
| Total | 17,697 | £71,479 10 6 |

### COPPER ORES SOLD AT THE SWANSEA TICKETINGS, FOR THE QUARTER ENDING MARCH, 1871:—

| Mines. | Tons. | Amount. |
|---|---|---|
| BRITISH. | | |
| Berehaven | 974 | £ 5,405 13 6 |
| Knockmahon | 552 | 2,213 16 6 |
| Ballycummisk | 46 | 226 15 0 |
| British Regulus | 11 | 312 8 0 |
| Total | 1583 | £8,158 13 0 |
| COLONIAL. | | |
| Cape | 2322 | £44,379 14 6 |
| Moonta | 1246 | 12,317 10 0 |
| West Canada | 586 | 7,802 15 0 |
| Paramatta | 603 | 5,439 17 0 |
| Australian | 65 | 580 7 6 |
| Total | 4822 | £70,520 4 0 |
| FOREIGN. | | |
| Sobral | 79 | £ 726 0 0 |
| Lisbon | 41 | 604 15 0 |
| Telhadella | 36 | 406 16 0 |
| Azambugeira | 17 | 323 0 0 |
| Total | 173 | £2,060 11 0 |
| RECAPITULATION. | | |
| British | 1583 | £ 8,158 13 0 |
| Colonial | 4822 | 70,520 4 0 |
| Foreign | 173 | 2,060 11 0 |
| Sundries | 532 | 5,298 15 0 |
| Total | 7110 | £86,038 3 0 |
| COMPANIES BY WHOM THE ORES WERE PURCHASED. | | |
| Copper Miners' Company | 656 | £ 5,739 11 3 |
| Grenfell and Sons | 889 | 12,286 7 0 |
| Sims, Willyams, and Co. | 695 | 9,366 15 0 |
| Vivian and Sons | 1117 | 11,366 6 0 |
| Williams, Foster, and Co. | 1905 | 22,383 3 0 |
| Mason and Elkington | 619 | 8,064 13 6 |
| Charles Lambert | 734 | 9,293 9 3 |
| Sweetland, Tuttle, and Co. | 496 | 7,537 18 0 |
| Total | 7110 | £86,038 3 0 |

TIN TRADE.—Mr. L. Th. van Houten (Rotterdam, April 29) writes—Prices have remained nearly stationary. The continuance of internal troubles in France tends very materially to contract business in that quarter within narrow limits, and the weakness of the English market has enabled buyers to execute orders there at prices considerably below the parity of our quotations. Notwithstanding this, the delivery of tin has again been very large, together 885 tons, being to a great extent parcels which had already been bought before, or in the last Trading Company's public sale. Some sales of Banca tin took place at 76½ fl. in the beginning of the month, but the market remained very quiet, with some business now and then for covering "bear" sales, and we close without animation at 76 fl., sellers. For delivery ex next Autumn sale transactions were reported at 73¾ fl. Billiton tin is still very scarce, the greater part of the quantity arrived having been previously disposed of when still afloat. A few parcels were sold at 75 fl. ex ship arrived, and 74½ fl. was accepted for parcels still afloat. A public sale of 7800 peculs Billiton tin was held in Batavia on April 5, which went off at 82 fl. per pecul, equal to about 76·80 fl. ex ship here. The position of Banca tin in Holland on April 29, according to the Official Returns of the Dutch Trading Company, was—

| | | 1871. | | 1870. | | 1869. |
|---|---|---|---|---|---|---|
| Import in April | Slabs | 18,043 | ..... | 32,320 | ..... | 8,620 |
| Total four months | | 45,528 | ..... | 74,432 | ..... | 31,202 |
| Deliveries in April | | 14,156 | ..... | 16,700 | ..... | 5,350 |
| Total four months | | 53,456 | ..... | 48,590 | ..... | 41,051 |
| Stock second-hand | | 98,235 | ..... | 91,121 | ..... | 104,469 |
| Total stock | | 143,051 | ..... | 149,495 | ..... | 131,424 |
| Stock of Billiton | | 7,422 | ..... | 7,400 | ..... | 5,682 |
| Import in April | | 8,471 | ..... | 7,600 | ..... | 7,718 |
| Delivered & shipped in April | | 4,100 | ..... | 8,600 | ..... | 6,158 |
| Quotation April 29.. | Banca | 76 fl. | ..... | 78 fl. | ..... | 79 fl. |
| | Billiton | 75 | ..... | 77 | ..... | 78½ |

The preceding returns of 1871, compared with those of 1870, exhibit—A decrease of the import for April of 446 tons, a decrease of the import for the four months of 903 tons, an increase of the deliveries for April of 233 tons, an increase of the deliveries for the four months of 152 tons, an increase of the stock second-hand of 222 tons, a decrease of the unsold stock of 424 tons, a decrease of the total stock of 201 tons, and a decline of the quotation of Banca of 2 fl., equal to 3l. 6s. per ton. The quantity of Banca tin now afloat for the Dutch Trading Company is 13,780 peculs, equal to 850 tons, against 19,300 peculs, equal to 1206 tons last year. We estimate the quantity of Billiton tin now afloat at 10,986 peculs, equal to 687 tons, against 6514 peculs, equal to 407 tons last year. The Government returns for the month of February are as follows:—

EXPORT OF TIN FROM HOLLAND.

| | February. | | | Two months. | | |
|---|---|---|---|---|---|---|
| | 1871. | 1870. | 1869. | 1871. | 1870. | 1869. |
| Germany ..Tons | 217 | 180 | 196 | 354 | 326 | 356 |
| England | 118 | 28 | 42 | 239 | 93 | 149 |
| Belgium } France } | 106 | 19 | 177 | 154 | 274 | 499 |
| Hamburg | — | 2 | 6 | — | 11 | 19 |
| United States | — | — | — | — | — | 18 |
| Othercountries.. | 2 | — | 9 | 24 | 9 | 9 |
| Total ..Tons | 443 | 229 | 430 | 771 | 713 | 1050 |

COPPER TRADE.—Messrs. Pitcairn-Campbell and Co. (Liverpool)—Quotations are 64l. 10s. to 65l. 10s. for Chili bars according to brand, 13s. 3d. to 13s. 6d. for good ores and regulus, 14s. 6d. for Corocoro Barilla, 70l. for Lota, 72l. to 72l. 10s. for Urmenota ingots. Business transacted during the fortnight comprises on the spot here 785 tons bars at 64l. 10s. to 66l. per ton, and to arrive 225 tons bars at 64l. 15s. to 66l. per ton. At Swansea 500 tons regulus and 380 tons ore at 13s. 3d. per unit, and 1300 tons Moonta and Newfoundland ore at 13s. to 13s. 3d. per unit. Arrivals here during the fortnight of West Coast, S.A., produce:—Achievement, from Coquimbo, 310 tons bars; John Elder, from Valparaiso, 370 tons bars, 226 tons ingots, 20 tons Barilla; Worrall, from Coquimbo, 729 tons regulus; Cicero, from Lota, 735 tons bars; Pole Star, from Valparaiso, 200 tons regulus; River Clyde, from Bolivia, 50 tons bars; Camana, from Tongoy, 800 tons bars, 60 tons ingots. At Swansea, Claudine, from Duendes, 390 tons ores, 300 tons regulus; Serena, from Taltal, 722 tons regulus; Glen Udal, from Coquimbo, 650 tons regulus, 100 tons bars; Caldera, from Carrizal, 490 tons regulus; Marquis of Worcester, from Tocopilla, 225 tons ores, 425 tons regulus; Professor Airy, from Caldera, 512 tons regulus; Gipsey Queen, from Pena Blanca and Huasco, 8 tons ores, 567 tons regulus. Stocks of copper (Chilian and Bolivian) in first and second hands, likely to be available, are—

| | Ores. | Regulus. | Bars. | Ingots. | Barilla. |
|---|---|---|---|---|---|
| Liverpool | 1923 | 2225 | 12,314 | 1657 | 591 |
| Swansea | 3284 | 7382 | 4,229 | 226 | 242 |
| Total | 5207 | 9607 | 16,543 | 1883 | 833 |

Representing about 24,400 tons fine copper, against 17,900 tons fine copper April 30, 1870; 10,350 tons April 30, 1869; 7800 tons April 30, 1868.

COAL TRADE.—Mr. J. R. Scott, the Registrar of the London Coal Market, has published the following statistics of imports and exports of coal into and from the port and district of London by sea, railway, and canal during April, 1871:—

| By Sea. | Ships. | Tons. | By Railway and Canal. | Tons cwt. |
|---|---|---|---|---|
| Newcastle | 134 | 82,067 | London and North-Western | 59,750 13 |
| Seaham | 8 | 2,766 | Great Northern | 79,106 0 |
| Sunderland | 87 | 48,297 | Great Western | 34,638 0 |
| Middlesborough | 11 | 4,598 | Midland | 103,444 0 |
| Hartlepool | 59 | 21,073 | Great Eastern | 41,473 3 |
| Scotch | 14 | 4,172 | South-Western | 121 2 |
| Welsh | 3 | 790 | London, Chatham, & Dover. | 1,105 0 |
| Yorkshire | 32 | 2,091 | South-Eastern | 772 18 |
| Small coal | 1 | 339 | Grand Junction Canal | 513 10 |
| Cinders | 5 | 609 | | |
| Total | 354 | 166,802 | Total | 320,924 6 |
| Imports in April, 1870 | 555 | 240,133 | Imports in April, 1870 | 293,845 11 |

COMPARATIVE STATEMENT, 1870 AND 1871.

| By Sea. | Ships. | Tons. | By Railway and Canal. | Tons. cwts. |
|---|---|---|---|---|
| Jan. 1 to April 30, 1870 | 2322 | 1,060,146 | Jan. 1 to April 30, 1871 | 1,435,105 18 |
| Jan. 1 to April 30, 1871 | 2020 | 976,868 | Jan. 1 to April 30, 1870 | 1,315,851 19 |
| Decrease in pres. year.. | 302 | 83,278 | Increase in present year.. | 119,253 19 |

## FOREIGN MINING AND METALLURGY.

The painful state of affairs which has been previously reported as prevailing in the Belgian coal trade still continues; the more the depression is prolonged the more it becomes grave and disquieting. Not only is France, the principal foreign outlet of the Belgian coal trade, now practically closed to Belgium, but countries which Belgium supplied with coal to some little extent during the war now seem to be doing scarcely any business with her. Thus, Belgium supplied for several months the coal requirements of Holland; but working operations having now been resumed in the basin of the Ruhr, the orders received in Belgium from the Low Countries have become insignificant. Northern of France Railway trucks continue to make default; and, further, the Northern of France Railway Company accepts for Paris only coal required either to supply its own works or those of the Parisian Gas Company. These wants being comparatively small, a very few collieries are enabled to supply them. Altogether, a good deal of distress is beginning to prevail among the working classes of Belgium, while the coalowners complain of an intolerable state of affairs, to which it seems very difficult to apply a remedy. In the Couchant de Mons the stocks accumulated, which on March 1 stood at 3,683,550 hectolitres, had increased on April 1 to 3,890,850 hectolitres. The stocks thus increased during March to the extent of 207,300 hectolitres. It should be added, also, that while the stocks stood on April 1, 1871, at 3,890,850 hectolitres, they amounted at the corresponding date of 1870 to only 2,060,554 hectolitres. The largest increase of stock has occurred in miscellaneous descriptions; the stock of qualities used for industrial purposes has rather declined. As soon as peace and quiet are restored in Paris a revival in affairs may be hoped for, especially if means of communication are everywhere promptly re-established. Wages, as well as prices, remain stationary for the present in the Couchant de Mons.

The state of the Belgian iron trade is much more satisfactory than that of the Belgian coal trade. All the works are actively occupied, and the orders on hand are sufficient to assure them employment until a cessation of the troubles in Paris is secured. Pig and castings of every description, as well as plates and iron adapted for building purposes, are sought after. From Germany, the North of France, and Belgium itself, considerable orders have been received. Belgian industrials are making great efforts to secure a sale for their products in the United States; and the demand for iron in America is so great at present that American orders do not make default, especially for rails. Unfortunately, Belgium can rarely share in the American orders addressed to Europe, not because the Belgian works are less satisfactorily tooled and equipped than their competitors, but because three-fourths of the deliveries of iron made to the United States are paid for in bonds, and Belgian industrials do not enjoy the same facilities as their English competitors possess for the disposal of these bonds. They are obliged in consequence to abstain from competing in many cases against English or German firms, the financial markets of London and Berlin being open to American securities, while the Brussels market has hitherto been closed to them. However this may be, a rather important order for rails has been accepted within the last few days in Belgium for South America. The annual report of the management of the Great Central Belgian Railway states that iron sleepers laid down four years since upon three miles of the line have stood well. The management expects to improve this description of sleepers by making a slight change in their form, which will add to their strength without increasing their cost. It has been found that rails laid upon these sleepers have suffered less than those laid elsewhere, which is attributed to the greater stability of the line. Bessemer steel rails laid on the Lodelinsart incline have also yielded favourable results. It had been feared that grave inconveniences would have arisen from these rails becoming polished; these apprehensions have not, however, been realised. The dividend of the Vieille-Montagne Zinc Mines and Foundries Company for 1870 has been fixed at 8s. per share.

A transaction has been noted in Chilian copper at Havre—25 tons, at 68l. per ton, Paris conditions. At Marseilles prices for consumption have been established as follows:—Toka, 70l.; Spanish, 70l.; Chilian and refined Peruvian, 72l.; rolled red copper in sheets, 80l. per ton. The German copper markets have become more active, transports being more easily effected. The Dutch copper markets have presented no change. There has been scarcely anything doing in tin upon the Havre market. At Marseilles, Banca has made 142l., and English 150l. per ton. There have been no great variations to note in Germany; prices have generally remained tolerably firm. Some rather considerable transactions have taken place at Rotterdam at 76 fls. to 76¼ fls.; an animated demand has prevailed to meet the requirements of consumption. Disposeable Billiton is held at 75¾ fls. to 76 fls.; some important arrivals of this metal are noted, but the greater part of these fresh supplies will be forwarded either to Germany or to England. No quotations have recently been recorded at Havre for lead, stocks continuing to make almost complete default. At Marseilles lead in saumons, first fusion, has made 18l. per ton; ditto, second fusion, 17l. 12s. per ton; rolled and in pipes, 20l. per ton. The German markets display rather more firmness. Zinc has been comparatively neglected at Breslau, although holders show themselves disposed to make some concessions.

At Essen (Prussia) industry is considered to be now reviving. The landwehr men who survived the Franco-German war are now for the most part returned; and the locomotives, trucks, and staffs of the local railways will soon be restored to pacific occupations. A great improvement may be expected, then, to result in the condition of the various works; for the present, however, the state of affairs is somewhat transitional. During the war, coal and coke rose to great prices, and they have not yet returned to their old level; metallurgical industry cannot, however, carry on operations with combustible at such dear rates, the value of pig and iron not having advanced in proportion. On the other hand, the great basin of the Rhine does not find itself under the necessity of securing supplies from the basin of the Ruhr. It is probable that in a short time the coalowners will abate their pretensions; meanwhile very little business has been passing in coal. Soundings are being continued in the north of the Ruhr basin, new companies are being formed, and a great number of new seats of working are being established. Although the production of coal in the Ruhr basin fell off slightly in the second half of last year it increased during 1870 upon the whole. The number of workmen employed in the collieries of the basin averaged 53,768 in the first half of last year, and 51,676 in the second half.

## FOREIGN MINES.

ST. JOHN DEL REY.—The directors have received the following report, dated Morro Velho, March 29: Morro Velho produce, second division of March, 10 days, 3014 oits.; yield, 2·454 oits. per ton. The work of sinking the new shaft is going on regularly.

DON PEDRO.—Mr. F. S. Symons, March 29: Produce weighed to date, 4179 oits.; estimate for month, 5679 oits.—Mine: No alteration to note—supply of ore mainly derived from lodes at Alice's west, which maintain their large size, and continue yielding average strake work, though none sufficiently rich for boxes. Operations in abeyance in bottom of mine. The cross-cut from Vivian's progressing. The middle adit has been in suspension, owing to Englishmen being required at other sections of the works. Treloar's level will in future be called the adit level. The rise from Treloar's to Alice's west has been timbered. When the tramroad has been laid to this horizon all ores excavated at this section will be transmitted through it, and Treloar's to strakes, and many hands relieved at present tramming. Explorations at Tambor and Mata de Cobras are being pushed on—nothing new to advise. The permanent machinery continues to arrive fast; it has been decided to secure the wheel-pit with stone. The erection of this machine will relieve us from the necessity of driving the deep adit, which from the experience acquired at Maquine would cost more than the pumping machinery.

ROSSA GRANDE.—Mr. Ernest Hilcke, March 28: The works have proceeded with regularity, and the features of the lode at the various sections are much the same as when last reported on; excepting in the stopes below the 60, where to our great disappointment the lode abruptly died out, after having extended down only from 6 to 9 feet. In the end of this level we have still a small size lode, which has a favourable appearance of making upwards, but the lode being so deceptive we cannot put much dependence on it. The stone treated from the Cachoeira Mine is poor, as far as he can judge from the appearance of the skins at the stamps.

GENERAL BRAZILIAN.—Captain Thomas Treloar, March 28: Our general operations have been carried on with the usual regularity, and nothing has occurred calling for special remark. The weather at present is fine, and the health of the establishment good. We have had little or no rain for the last four days, and the benefit of same has already become manifest at various points of operation. At the shallow adit at St. Anna the water coming from the end is a little less, but the ground is still wet and troublesome; notwithstanding the men, though slowly, continue to advance.

ANGLO-BRAZILIAN.—F. S. Symons, March 29: Capt. Treloar, the consulting engineer, visited establishment and went over works on the 21st. It was decided that owing to present poverty of stone at Dawson's, and heavy loss last month, the works at this section be suspended, and force concentrated at deep adit, Foster's, and the Fundao. The erection of pumping machinery will be suspended.—Mine: No alteration to note. Tramway from Fundao to Foster's have been completed, and next month we hope to break a large quantity of the stone and fairly test its standard. The accumulation of debris cleared has been very large. Communication from deep adit to Foster's will be completed next month. Attendance of force has been good, and sanitary state of same not quite so favourable as in last month.—Pitanque and Agoa Quente: On the 21st current I received a letter from Capt. Treloar informing me that these properties had been purchased for this company, and requesting me to take charge of same. On the 24th I proceeded there, and organised a small force to commence shallow adit, repair and clean buildings, of which there are on the estate sufficient to accommodate a good force, and make roads. Judicial possession will be taken on the 10th, and arrangements decided on as to future working, and plans for development of property decided on. The works at Passagen will be curtailed, and part of force drafted to Pitanque, where for some time requirements will not be large. Operations both at Passagen and Pitanque will be carried on in a most economical manner.

EXCHEQUER (Gold and Silver).—L. Chalmers, April 10: The timbering in the 50 ft. level is all but completed, and 18 ft. were made in the south drift from the 140 ft. level. This I am now pushing with double shifts, so as to commence stoping as soon as possible.

ANGLO-ARGENTINE.—Capt. J. Vivian reports for February: The whole of the machinery is now delivered, and, I am glad to state, in good condition. The erection of the same is being pushed on with all possible dispatch. We hope to commence pumping on or about March 20. Shortly after we shall begin building foundations for stamps, which will be erected as quick as possible. When completed, together with all the other machinery to connect therewith, such returns will, doubtless, follow as will be highly satisfactory to all parties concerned.

TAQUARIL.—T. S. Treloar, March 28: The works generally are advancing, and satisfactory duty is being done, but the auriferous quality of the ore treated has again fallen off. The lode at Pinga d'Agua has been struck, but sufficient has not been seen to enable me to write more about it by this opportunity. The consulting engineer is daily expected.

COLORADO TERRIBLE LODE.—The directors have received account of 9 tons of ore sold by public ticketing in Liverpool, on April 17, at 125l. 1s. per ton of 20 cwts. Assay for silver being 505½ ounces; ditto for lead, 24 per cent. They have also received a bill of lading for about 10 tons to arrive per steamship Cuba, the value of which, according to an assay made in Colorado, is expected to prove above that of the foregoing shipment. A third consignment also left Georgetown early in April.

ECLIPSE.—The following is an extract from a letter from Mr. Henry Tregellas, under date April 2:—Our mine is looking splendid in the shaft for gold. In sinking the last 40 ft. we have had a lode 8 ft. wide, showing gold very freely, not as "specimens." I stood at the mouth of the shaft yesterday, and as the wagons came up full could see plenty of gold, in rocks as large as your body. We get up steam to-morrow, and hope to be stamping in a few days.—[The rock, weighing 150 lbs., and the silver ore referred to by Mr. Henry Tregellas in his report under date Feb. 17 (received March 18), have arrived, and can be viewed at the offices of the company.]

FRONTINO AND BOLIVIA.—The directors regret to have to inform the shareholders that, owing to the mail from the interior of South America having been plundered on its way to the coast, they are without their usual advices and remittances of gold. The only particulars which the directors have received are contained in the following extract from the *Daily News* of April 29: "Barranquilla, March 29.—The Baranquilla steamship, with mails from the interior, arrived here on March 26, behind time, having been aground for three days. The mails and gold specie were forwarded to Santa Martha in a cana, but on the 27th the men in charge returned and reported that during the night they were attacked by armed men, who plundered the cana of all gold, specie, &c., and took besides the list of remittances from the postman. It is not known exactly how much was stolen, but it is believed that the remittance from Antioquia alone was $300,000." As the remittances of gold forwarded from the mines are always ensured, the company will not suffer by the robbery, except in having to wait until the middle, or perhaps the end, of the present month, before receiving the report from Mr. Rouch upon the Bolivia Mines and their prospects, alluded to in the circular of April 3 last. It will be satisfactory to the shareholders to hear that in a letter from Mr. Rouch, written from the Bolivia Mines, received by the April mid-monthly mail, he states that he is in the midst of reforms and improvements, which he will carry out thoroughly; that he has no doubt whatever of good success; and that his new improvements in the stamping-mills, which worked so well at the Frontino Mine, he had already applied to some of the mills at Bolivia, the cost being less than 70s. (English). Mr. Rouch's letter adds that "there is abundance of mineral laid open to supply fully the mills."

BATTLE MOUNTAIN.—Captain Richards, April 6: Virgin: In the 113 feet cross-cut, driving west from Hallow's shaft, there is no doubt now, I think, of our having cut the lode, although from the extreme hardness of the ground but little has been done comparatively. So far as I can see the lode is going to keep its course here, and pass through the cross-course. The lode contains a little ore, which is all we can expect, seeing that it has two cross-courses to contend with—one here and one at Roach's winze. The lode in the 73 feet level north is still of large size, without ore, and is now suspended during the sinking of Moore's winze, which has been resumed in the bottom of this level. The lode in Moore's winze contains a large quantity of iron, of no value; near the hanging wall there is a very small quantity of exceedingly rich black oxide of copper, and, although small, it is tracing the lode down deeper than any ore has been before seen, which is important. In Jack's stope, in the back of the 73 north, some good ore is still being broken, although the quantity remaining there now must be in all probability small. In the stope in the back of the 113, at Roach's winze, the lode has to contend with the cross-course, and is consequently disordered thereby, producing ore, but of much lower average produce than formerly, which greater depth, and getting out of the influence of the cross-course, will, I hope, remedy.—Lake Superior: Moore's rise, in the back of the 70, south of Pryce's shaft, has been holed to the surface, as per advice last week, and a pare of men are now stoping in the back of the level at the rise, from

which we obtained some very rich ore. I do not anticipate, however, much ore from the stopes, and in all likelihood the men may be put to drive this level south, in the hope of meeting with ore, and also the junction of this with Virgin lode, which is a very interesting point to carry out, and one which ought to reward us liberally for so doing. In Pryce's shaft, sinking below the 70 ft. level, the ground is harder, and consequently slower of progress; no ore is now to be seen, but iron pyrites, which for the time seems unaccountable. More men have been engaged to force on some good points, and still more are required to carry out some important work. We should now, as soon as the 113 is far enough advanced out of the way, commence sinking Hallow's shaft below the 113, and this shaft should be continued down for about 90 feet, when a cross-cut to the lode, I am of opinion, will find it much more settled, out of the unfavourable influence of the cross-courses, and resuming its former size and richness of character. You will see we are justified in believing this, for even now, so interfered with by the two cross-courses, it is holding down and producing ore at a depth of many feet below the point at which it was supposed to entirely fail, and too much importance, therefore, cannot be placed on this fact. I am pushing forward another parcel of ore as fast as I can. There have been 505 sacks raised during the week.

NEW ZEALAND (Quartz Crushing and Gold Mining.)—The advices which have been received by this mail, *via* San Francisco, are very satisfactory as to the future prospects of the workings in the colony. The manager, writing under date March 6, says, "I am very pleased to find that the Government engineer here has instructions from head-quarters to receive tenders immediately for the construction of the tramway up to the Tokatea ranges. If this line is completed before the wet winter, we shall have quartz in abundance from all quarters of the field." From the newspapers, which have also come forward by the same mail, it would appear that things are looking brighter out there. An extract from a colonial paper, which has been forwarded by Capt. Thomas, says, "Mr. Simpson, field engineer of the Thames, is at present at Coromandel, taking steps for the immediate commencement of a tramway up the Tokatea range. This important work cannot fail to prove a great benefit to the mines at Coromandel." A notice appears in the *Daily Southern Cross*, of the 27th February, to the effect that arrangements had been made by the New Zealand Company with the Puketutu Gold Mining Company to work the great Puketutu quartz reef, and that several men were to be put on at once, to break out a fair sample lot, when if it were found after experiment and trial that the lode were capable of being worked profitably, it would be the means of adding largely to the company's receipts. An agreement has since been made by the company's manager, Capt. Thomas, to work the Puketutu quartz reef on very satisfactory terms. The same paper further observes, "The purchase of interests in a claim, which I mentioned in my last, had reference to the Swedish Crown two-thirds of the mine having been bought by Mr. John Rowe and Co. The whole of the quartz now raised will be taken to the New Zealand battery for immediate crushing," &c. It would appear from the above that business is getting more brisk at Coromandel, and that there is a large field there for successful gold mining and crushing operations. Capt. Thomas states, "We have quite established the reputation of our machinery during the past few days for its gold-saving qualities, &c. Having got a trial lot of quartz from the Flying Cloud claim of 17 tons to crush, against 18 tons of the same pile of quartz that was crushed at the Nil Desperandum battery. New Zealand's Company's battery crushed 17 tons, yielding retort gold 11 ozs. 11 dwts. 12 grs., melted 11 ozs. 5 dwts.; Nil Desperandum 18 tons, yielding retort gold 11 ozs. 17 dwts. 12 grs., melted 11 ozs. 4 dwts. 18 grs.; New Zealand Company's battery, average yield per ton 13 dwts. 5 grs.; Nil Desperandum battery, average yield per ton 12 dwts. 11 grs., showing the New Zealand battery gained 18 grs. per ton, or 12 dwts. 18 grs. in the 17 tons, sold at 59s. 6d. per ounce, 1*l.* 17s. 10d. over the value obtained from the 18 tons crushed by the Nil Desperandum battery. This result proved to be very satisfactory, and will in consequence at all times command all the quartz. Where there are no large interests in the claims held by the other two batteries, or by shareholders who held interests in both claims and machines, all free and non-interested claims, we are sure to get a preference for the crushing, and have got it hitherto." This is confirmed by the newspaper reports by the present mail. The crushing account for the month of February may be inspected at the company's offices.

VAL TOPPA.—Thomas Roberts, Thomas Vaughan, J. Roberts: The lode in the end driving north from second cross-cut west, in No. 3 level, yields 10 tons of ore per fathom, worth 14 dwts. per ton; and the driving south of cross-cut has improved, producing 9 tons per fathom, at 9 dwts. per ton. The driving south on the quartz lode, below No. 2 level, continues its size and character, giving 12 tons per fathom, worth fully 1 oz. per ton. The end driving north and south on the new lode, in No. 2 level, remains of the same value as last week. The winze sinking under this level is producing 10 tons of ore for length of winze, worth 10 dwts. per ton. The rise above this level is at present poor. The end driving north on western part of the great quartz lode, above the No. 2 level, is now producing 9 tons of ore per fathom, worth 18 dwts. of gold per ton. There is no change in the end driving south. The lode in No. 2 stopes, on the flat lode, is diminished in size, and at present estimated at 6 tons of ore per fathom, and worth 12 dwts. of gold per ton.

PESTARENA UNITED.—April 24: The stopes in the back of the 16 yield 7 tons per fathom, worth 16 dwts. of gold per ton. The end driving north in the 33, on No. 2 lode, gives 4 tons per fathom, worth 12 dwts. per ton; and the stopes in back of this level 5 tons of ore, at 1 oz. of gold per ton. Stopes in back of the 46, on No. 2 lode, yield 5 tons per fathom, worth 10 dwts.; and the stopes in bottom 4 tons, at 1½ oz. Stopes in bottom of the 75 yield 10 tons per fathom, worth 1 oz. per ton. The north incline engine-shaft, sinking under the 80, yields 7 tons per fathom, worth 1 oz. of gold per ton.—Boundary: The stope in bottom of the 20 gives 6 tons per fathom, worth 14 dwts. per ton.—Aquavite: Stope in back of adit, north of engine-shaft, gives 7 tons per fathom, worth 8 dwts. per ton. The 23 end, driving south, is poor; stope in back of this level 4 tons, at 1 oz. per ton. Stope in back, north of engine-shaft, 7 tons, at 10 dwts. per ton. The 46 end, driving south, yields stones of ore. The 55 end, driving south, yields 3 tons per fathom, worth 12 dwts. per ton; and the 55 end north 8 tons, at 14 dwts. per ton.

May 3.—G. Franzi: 526 ozs. of gold from 768 tons of ore for the month of April.

LUSITANIAN.—April 25: At Taylor's engine-shaft, below the 40, the lode is worth 2 tons of ore per fathom. At the 140, east of Taylor's, the lode is 1 ft. wide, and worth 2 tons of ore per fathom. At the 140 west the lode is 4 ft. wide, and worth nearly 1 ton per fathom. At the 130 east the lode is 6 ft. wide, composed of quartz. At the 130 west the lode is 4 ft. wide, worth 1 ton of ore per fathom. At the 120 east the lode is 8 ft. wide, composed of quartz and ore, worth 1 ton per fathom. At the 110, east of River shaft, the lode is 2 ft. wide, composed of quartz and stones of ore. At the 90 east the lode is 4 ft. wide, and worth 1½ ton per fathom. At the 70 east the lode is 4½ ft. wide, composed of quartz and small stones of lead. At the 38, on Mill lode, the lode is 2 ft. wide, yielding 1 ton per fathom. At the winze in the 85 the lode is 5 ft. wide, composed of quartz and stones of ore. At the 86 and 87 the lodes yield each 1 ton per fathom.—Carvalhal: At the 60, on great lode, the lode is 8 in. wide, composed of quartz, spotted with lead. At the 50, east of incline, the lode is 3 ft. wide, worth 1 ton of lead per fathom. At the 40 east the lode is 1 ft. wide, composed of quartz and country. At the 30 east the lode is 3 ft. wide, composed of quartz and stones of lead. At the adit level, west of incline shaft, the lode is 2½ ft. wide, worth 1¼ ton per fathom for lead and blende. At the 10 west the lode is worth 1¾ ton of lead and blende. At the 20 west the lode is worth ½ ton; the 30 west the same. The 30, north of great lode, is worth ¼ ton of lead and blende per fathom.

WEST CANADA.—F. Williams, April: I addressed you last on the 11th ult., at the same time sent you the setting list for March. I now beg to hand you the following report of our proceedings since that date:—Huron Copper Bay: The stope in the bottom of the 20, east of Stephen's winze, still yields 3 tons of ore per fathom. We have secured the weak ground over this stope with a strong stull, and I do not think that we shall have any further trouble with the sides for a long time to come. The stope below the 35, west of Palmer's shaft, produces 2½ tons per fathom. The lode in the 50, driving west of this shaft, is still poor and unkindly, yielding about ½ ton of ore per fathom. The stope in the bottom of this level looks pretty well, yielding 3 tons per fm. The lode in the 60, west of shaft, is still poor, but it is getting much wider, and no doubt it will soon make a good bunch of ore again. The lode in the 60, east of Bray's engine-shaft, is again improved, and yields fully 2½ tons per fathom. The stope in the bottom of the 35, east of this shaft, still yields 2¼ tons per fathom. The stope on east of this shaft, over the 35, still looks well, and yields 3¼ tons. Lode in 35 has improved, and yields 2 tons per fathom.—Wellington Mine: The stope east of Rowe's shaft is worth 2¾ tons per fathom. The stope west yields at this time 2¼ tons per fathom. The lode in Rowe's shaft is still getting smaller as we descend, but we hope soon to see it open above to its usual size again; yields above 2 tons per fathom. I beg to say that all our surface operations are going on in a regular way.

[For remainder of Foreign Mines see to day's Journal.]

PACIFIC MINING COMPANY.—A change in the management of this company's mine (the old Lane and Fuller) has just been made, Captain Brown having been superseded by Captain H. Prideaux, a gentleman familiar with Lander Hill, and particularly with the mine under his immediate charge. Owing to some little ill feeling on the part of the late superintendent towards his successor, the latter has found the mine in a very bad fix, the machinery broken, and the works flooded in consequence. He has been working as diligently as possible to set things to rights, but it will be three weeks before he can get the machinery repaired and the mine pumped out. Captain P. is confident that he can make the Buel North Star (for that is the name of the mine) a paying concern for his company, and a credit to our district, and we know of no reason why he should not. That the mine has yielded abundance of rich ore is a fact known to every one here. The late superintendent pretended that when he took charge of the works he discovered that matters had been misrepresented by the old company; that nearly all the ground from the lower level had been worked out, whereas the impression of the purchasers was that the greatest part of it was intact, and he conceived a disgust which he took no pains to conceal, and which, we think, warped his judgment throughout the whole of his administration. Captain Prideaux knows the mine and has faith in its merits. He expects to be taking ore out of it in the course of a week or so after his machinery is repaired and the work cleared of water. We share his faith in the permanency and richness of the mine, and expect to see the Pacific Mining Company figure among the successful ones on Lander Hill.—*Reese River Reveille.*

COLORADO TERRIBLE LODE MINING COMPANY.—Under the superintendency of Mr. R. O. Old, the affairs of the Terrible Lode Mining Company have been placed on a basis that will insure satisfactory dividends to the stockholders. It was announced a few weeks since that the Terrible tunnel, 357 ft. in length, had cut the vein at a depth of about 200 ft. from the surface, and that a fine body of rich ore had been uncovered in the face of the tunnel. We shall now proceed to give a brief description of the workings of the mine and other matters which have a direct bearing on the economical working of this property and the treatment of the ore. The number of feet sunk, including the drifting on levels, three in number, and the length of the tunnel, amount to 1630 ft. The tunnel strikes the vein 240 ft. west of the discovery shaft. The second and third levels are connected with the tunnel by a winze. Drifting west from the face of the tunnel, while stoping is going on in the ground already opened, will go forward rapidly, and consequently the ore yield will constantly increase. It is estimated by the superintendent, Mr. Old, that with the present amount of stoping ground opened the mine will yield per month—of first-class ore, 15 tons; second-class ore, 60 tons; third-class ore, 100 tons: total, 175 tons. It will readily be seen that the amount of the stoping ground will be greatly increased in a few months, and that the ore yield will, therefore, be proportionately increased. The mine hitherto has been ventilated, drained, and the ore and rock hoisted to the surface by steam-power. The expenditure of money for the above items ceased with the completion of the tunnel, and the expense items for engineers, wood, and wear and tear of machinery, will, hereafter, be placed to the profits of the mine. In all the workings of the mine, with one slight exception in the first level, ore bodies, in many instances of remarkable richness, are in sight. The Terrible Mine is now in good working condition, and, with the large amount of ore in sight, the owners of the above property can confidently expect nice dividends at the end of every quarter. A wire suspension tramway, 600 ft. in length, will soon be built and in operation to convey the ore from the ore-house, at mouth of the tunnel, to a mill soon to be erected at the base of the mountain. The mill is designed only at present to crush and concentrate ores. The Wagner crusher and the Krom dry ore concentrators will be used. The mill when erected will have a large capacity. The constant shipments of first-class ore to Swansea, Wales, and the large amounts of second and third-class ore treated here, furnish sufficient evidence that the Terrible is a remarkable true fissure silver vein. An assay lately made by C. C. Burlingame, territorial assayer, of galena taken from the Terrible gave a yield of $1411·80 in silver per ton. Another assay from the same material, made by Fred. A. Clark, gave a yield of $1515·80 in silver per ton.—*Colorado Miner.*

# Meetings of Mining Companies.

## BLAEN CAELAN COMPANY (LIMITED).

The half-yearly meeting of the company was held on the mine, at Talybont, and, by adjournment, at the Queen's Hotel, Aberystwith, on Friday, April 28, Mr. G. W. CHARLWOOD in the chair, and present a full quorum of members, holding 12,257 shares.

Mr. FERGUSON read the notice of meeting; the balance-sheet for the half-year ending March 31, of which we gave a summary last week; and the auditors' report confirming the same.

Mr. BALCOMBE read the agents' report, as follows:—

BLAEN CAELAN: Since October the shaft has been sunk 9 fms. 3 ft. under the 10, and we hope to start a 20 fm. level in about a month from this time. The shaft is carried down in a line with the last draft (adit to 10), but it is not equal to the underlie or dip of the lode—thus the lode is standing to the north of shaft. When the shaft reaches the 20 we shall put out a short cross-cut to the lode, on reaching which we shall extend levels east and west on its course. The ground at the bottom of the shaft is composed of killas of a highly favourable character for the production of mineral. The bargain is worked by six men, at 15*l.* per fathom. The 10 east has been extended from the shaft 40 fms. on a lode from 3 to 4 ft. wide, composed of killas, friable spar, intermixed with lead ore, worth in places from 30 to 35 cwts. per fathom. The lode in the end is not looking quite so well, is a little disordered, and worth 15 cwts. per fathom; but this falling off corresponds with the upper level, which passed through a similar bar of ground. One stope only is working in the back of this level; lode worth 30 cwts. of lead ore per fathom. The stope in the back of the adit east of the south cross-cut is looking exceedingly well, and is worth 2 tons of ore per fathom for about 8 fms. in length; this bargain is worked by six men, at 35*s.* per fathom. Four men are stripping down the lode south of cross-cut; lode worth fully 1 ton of ore per fathom; and we shall now put on a pare of men to stope further east in this level, where the lode is also worth 1 ton of lead ore per fathom. The cross-cut north from the adit has been extended 30 fms.; the level has crossed several branches containing copper and lead ore; we do not think that these branches will prove to be the north lode, and deem it advisable that the level should be extended further for proof of same, but we have taken the men from this place for a short time. The main adit has been communicated with the old adit, which has given good ventilation, and a much more convenient inlet and outlet for the mine. In conclusion, we beg to say that the mine is looking well, and, if the different stopes and levels continue to yield their present produce, we hope in the coming six months to sample 300 tons of lead ore. Surface-buildings and dressing are being pushed on with all possible energy consistent with economy.—THOS. KEMP, Inspecting Agent; JOHN EVANS, Resident Agent.

And also the following report of the managing director:—

The company consists mostly of original members, and I may, therefore, address myself, for general information, to the principal points of progress from its formation. Only thirteen months since I had the pleasure of inviting your co-operation and subscription for the development of this property; and, although I carefully guarded against the probability of any charge arising from an exaggerated notion of value, I plainly intimated that my experience led me to entertain a very favourable opinion of the property as it stood—at the same time, I assured you that the management of the company's affairs should, in furtherance of that opinion, have my utmost watchfulness and care. The gratifying confidence with which my invitation was met, the rapid subscription of the capital, together with the energy of the agents, and, in fact, of every employee on the mine, has brought about an almost unprecedented success in a very short space of time. Personally, therefore, I may claim credit for the redemption of my promise, and, in thanking you for your confidence, we may congratulate each other as being the possessors of a most valuable property. We had an exceptional winter season to go through, and the continued frost greatly retarded the mason work of the buildings necessary for the manipulation of the product of the mine; but, although that was so, the provision made in the summer by the erection of the 8-horse power engine over the shaft in the adit enabled the underground workings to be kept on without the loss of a single day. Its influence on our prosperity is possibly not fully appreciated, but it will be clearly evidenced by the following statement of the ground actually broken in the mine since we commenced operations:—Length of levels extended and cross-cuts opened, 186 fms. 2 ft. 3 in.; shafts sunk, 9 fms. 3 ft.; winze completed from the adit to the 10 fm. level, 4 fms. 3 ft.; ground stoped above the level, east of adit, 24 fathoms 4 feet; ground stoped for the construction of the engine-house room and coal stores (Little Wonder engine), 16 fathoms; ground quarried east of the main adit for building stone (cubic fathoms), 192 fms.—433 fms. 0 ft. 3 in. This statement, and the knowledge that the lode above the adit level is certainly worth from 1 to 2 tons of lead ore per fathom, shows clearly that the dressing appliances of the mine have been much behind its productive capabilities, and that such a lode in an ordinary mine having those appliances would have been stoped in an inverse proportion to the figures which refer to levels opened. In other words, if the mine were large enough to admit of (say) 86 fathoms of levels being productively driven, the ground above and below such levels would in most cases have been broken or stoped at a low cost, to the extent of quite 250 fathoms. Therefore, the value of the engine in enabling those works to proceed regardless of weather is apparent, and the availability of this ore ground for future returns must be palpable enough. In my circular letter to you of Dec. 5 I gave the following particulars, after a personal inspection of the mine:—"We have upwards of 30 fathoms long of ore ground in the south lode, east of adit, which in one place is laid abroad for 32 feet, carrying ore from wall to wall. In the level below this we have good ore ground, worth 2 tons of lead ore per cubic fathom; this end is some fathoms short of the perpendicular of the rich ore just mentioned; it will, doubtless, improve in a similar manner, and continue ore bearing for the same length when the level advances east. The last-named level is 35 fathoms from surface, and the lode is wholly unbroken—in fact, the ore deposit in each level will be immediately available when the machinery of the dressing-floors is ready for its manipulation. By that time we shall have the engine-shaft down 20 fms. below adit, and if the lode only holds equally good (of which no doubt exists, lead being visible in the shaft now) we may reasonably calculate that each 10 fathoms in depth, by 30 fathoms long, and 32 feet wide, will yield, even at 1 ton per cubic fathom, 20,000*l.* in lead ore." Since that date, as you know, I have not been able to go underground, but as we may confidently rely on the experience and on the integrity of our agents, you will notice with satisfaction that their joint estimate for the current half-year's returns 100 tons of lead ore in excess of that given in my approximated statement sent out with the balance-sheet about 10 days back. And they are the more correct, for so far as present experience goes our lodes will yield from 25 to 40 cwts. per fathom. Eighteen men are now engaged stoping the ore ground, at an average of 35*s.* per cubic fathom; to make wages (15*s.* to 17*s.* per week, net) these men must break more than 40 fathoms of ground in four weeks, which, averaging 30 cwts. per fathom, should yield to the company 60 tons of ore per month, irrespective of whatever lead may be raised by the extension of levels or from fresh discoveries. This exceptional state of things, and the determination on my part that the increased depth and development of the mine shall certainly keep pace with the ore ground so to be broken away, justifies, in my opinion, the most sanguine hope of a long career of prosperity to the company. With regard to surface erections, those members present can judge for themselves, but as they may represent but a small proportion of the proprietary, I may be allowed briefly to state that when the buildings, &c., are thoroughly completed I believe we shall possess as effective a field of machinery, with auxiliary power against excess of water, drought, or frost, both underground and at surface, as any mine in the Principality. Owing to the lamented death of Mr. James Rhodes, Mr. H. B. Barker, of Whitehaven, has intimated his desire to be elected a director of the company. The special resolutions, of which notice has been given, are to fortify an application to the Committee of the Stock Exchange for an official quotation in the daily list.—J. B. BALCOMBE.

The CHAIRMAN moved the first resolution, and said he did so with the utmost gratification, for he must confess to no small amount of surprise at what he had witnessed to-day, and the great strides in the development of the mine, both underground and at surface, since he was on the ground in October. The intervening period had not been favourable for surface operations, yet the inspection which the party—himself and nine others—had of the underground works, and the rich ore there exposed, justifies all that has been done, and only proves the soundness of the judgment which governs the undertaking. He (the Chairman) remembered the excellent managing director saying at the October meeting "that the loss of time in erecting the machinery might be unfortunate, but that it was better to be certain of the ore first, and the machinery would soon follow." They have the ore now, and it would take any person a very long walk to find such another pile of ore on surface as is at Blaen Caelan. He had no doubt whatever but that the advice of Capt. Edward Williams (late of Dyliffe) in March last, and under which he and his colleague (Mr. C. W. Price) entered on the undertaking, would within a reasonable time be amply verified, and that Blaen Caelan, as "the Cardiganshire Van," as Capt. Williams then christened the mine, would presently realise more than 100 tons of lead ore per month. Capt. Williams had seen the mine again to-day, and he had fully endorsed that opinion to him (the Chairman) after his lengthened underground and surface visit. However, Mr. Balcombe, in his excellent report, has so fully explained—and, in fact, exhausted—the whole subject, that he would now move—"That the accounts and reports be passed and printed." Carried unanimously. The following resolutions were then passed:—

Resolved unanimously,—"That a dividend of 1000*l.* be declared, payable on June 15, and that the balance of 1397*l.* 1*s.* 7*d.* be carried forward."

Resolved unanimously,—"That Mr. H. B. Barker, of Oak Bank, Whitehaven, be elected a director, in place of Mr. James Rhodes, deceased."

Resolved unanimously,—"That the directors be authorised, out of the profits of the company, to pay interim dividends in January and July of each year."

Resolved unanimously,—"That there be added to section 28 of the Articles of Association the following words:—'But the board of directors shall not employ any portion of the corporate funds of the company in the purchase of its own shares.'"

Resolved unanimously,—"The following words in section 65 of the Articles of Association—'All dividends unclaimed for three years may be forfeited by the directors for the benefit of the company' be and are hereby cancelled."

Mr. J. N. BROWN (Cannock Chase) proposed—"That the best thanks of the shareholders are due to the managing director, the other directors, and the agents of the company, for the spirited way in which the works of the mine and the business of the company has been conducted, which, in his opinion, reflects the greatest credit, more particularly, on our excellent managing director."

Seconded by Mr. CECIL BIRCH (Kensington), and carried unanimously.

Mr. BALCOMBE, on behalf of himself and his colleagues, thanked the shareholders for the compliment, and said that the directors had kindly reposed full confidence in him, and he was quite conscious that it had not been misplaced. (Cheers.) Everything had been done as well as it could be after it was clearly ascertained that the riches of the mine justified the outlay. He (Mr. Balcombe) was not accustomed to do things by halves.

A SHAREHOLDER: We have only to look at this noble building to prove that.

Mr. BALCOMBE resumed, and said one compliment was enough at a time; and, referring back to the mine, said that although he held half the shares in his own name he had worked equally hard for the other half, which was spread amongst 93 proprietors, and he sincerely believed that evidence of greater profits were close at hand, and that a few months only would amply justify all that had been said of the mine, which, happily, did not require puffing, as well as of the inherent sound character of the undertaking.

After a few more complimentary votes the meeting separated.

## GREAT ROYALTON TIN MINING COMPANY.

A general meeting of shareholders was held at the offices, Finch-lane, on Thursday,—Mr. JAMES H. CROFTS in the chair.

The notice convening the meeting was read, and the minutes of the last were confirmed. The balance-sheet was presented to the meeting, showing a cash balance against the adventurers of the sum of 190*l.* 9*s.* 2*d.*, and a balance of liabilities over assets to the end of March of 551*l.* 8*s.* 9*d.*

The agent's report was read, as follows:—

*May* 1.—Since your last meeting we have driven on King's lode, at the 22, about 12 fms. east of the cross-cut; the lode has been large throughout. This drivage near 20 ft. wide you will, I fear, be somewhat disappointed in not having so much tin sold as I promised you in my last quarterly report. The fact is that we have done a great deal of dead work both at the surface and underground, and this has taken more time than I anticipated, but now the work being done we shall raise more tin. The work being done at the 22 is driving 12 fms. on King's lode east, which has cost us a great deal of time and labour, and now this will lay open two stopes, in which two men will raise as much tin in stoping as four will in driving; and I am still pushing on the east end, as we have about 4 fms. to drive to reach the rich tin ground gone down below the adit, and then 6 fms. further east we have the great north lode intersecting King's lode; this is a most important point, and I think large deposits of tin will be found here. This point will be reached by the next meeting, when I feel confident I shall be able to report to you a great improvement in the mine generally. We have also fixed a horse-whim to draw from the 22, and laid out additional dressing-floors for the 16 extra stamps; all this extra work will not have to be done again. At the adit level we have driven east only about 4 fms. since the last meeting, as we had stopes to take away. We have had some good stones of tin here, but not so good as at the 22. We have also driven a cross-cut north, and cut into the great north lode, and found some rich stones of tin, but there being an old shaft here, and the ancients having taken away the greater part of the lode, I am unable to report much about this yet; it will take me another week or two before I shall be able to report fully. Looking at this north lode intersecting King's lode, I am of opinion this will be the making of this mine, as this junction made large deposits of tin shallow from the extensive workings of the old men, and there cannot be a doubt that in deeper levels this will be found much richer, and on the west there are several lodes forming junctions with King's lode. Only depth is wanted here to make this mine a great success, and I would recommend the sinking of the engine-shaft at once, and to get at these points at the earliest moment. The prospects of the mine are better now than I ever saw them before, and the returns for the next three months will be considerably over that of the last three months. These large lodes cannot fail in making rich in depth. Mr. Henwood, of London, will be here to-day to inspect and report to you. I hope his report will be in time for the meeting, and by your next meeting I shall be in a position to report the junction of lodes at the 22, when I feel assured a rich mine will be found.—THOMAS PARKYN.

A report was also read from Mr. George Henwood, a copy of which will be found in another column.

The CHAIRMAN, in referring to the agent's report, remarked that it would be seen that a large amount of dead work had been done, the effects of which would be felt in the next three months. They would remember that in the last report the agent had recommended the sinking of the engine-shaft 10 fathoms, but in February he had advised the committee to put off the sinking until the north and south lodes had been cross-cut; this had now been done, and they had just reached lodes whereby they could open additional stopes; the engine-shaft would, therefore, be sunk deeper with all dispatch. He (the Chairman) might mention that the pumps were on the mine, and were charged in the present liabilities. A tramway from the shafts to the stamps would shortly be laid down, and effect a great saving in labour. Though they could not yet congratulate themselves on being on the right side of the balance-sheet, judging from the reports, it could not be long before they were so. In the balance-sheet all costs and bills had been charged to the latest possible date—the end of March. Shareholders would observe that a great amount of old liabilities had been paid off, and the liability on that head was now reduced to 275*l.* The costs were brought down to the lowest point compatible with efficiency. (Hear, hear.) They had 50 persons employed, their tin had realised excellent prices, and the total sales had amounted to 312*l.* The Chairman remarked that it would be a source of great satisfaction to see such a high mining authority as Mr. Henwood speaking so favourably of Great Royalton, though it only confirmed the opinion of all practical men who had seen the mine; all they wanted was depth. The Chairman concluded by formally moving the reception of the accounts and adoption of the report.

Mr. FERDINAND R. KIRK, in seconding the motion, said the Chairman had exactly expressed his own conviction when he said all they wanted was depth. Nothing could be better arranged or in better working order than the stamps and dressing-floors, and indeed all the machinery. He thought they could not reasonably expect any great discovery until they went below the ancients. If they put their shoulders to the wheel and effected this, humanly speaking there could be no doubt of the result. Great Royalton, he was convinced, had within it riches equal to any mine in the county. (Hear.)—The motion adopting the report and accounts was then put and carried unanimously.

The CHAIRMAN said they had now to consider the call. Considering that they were about to incur extra cost in sinking, and that there yet remained some of their old liabilities, he thought they would not be justified in making a call less than 3*s.* per share.

It was proposed by the CHAIRMAN, and seconded by Mr. J. CROFTS, that a call of 3*s.* per share be made, payable within 14 days.

The CHAIRMAN said they would see from the notice paper that they had lost one of the members of the committee by death. He alluded to Mr. Robert Norfolk, senior, who had been one of the earliest shareholders, and had always taken an active interest in the mine, and they much regretted his loss. He moved that Mr. John Norfolk be elected a member to supply the vacancy, which was carried. A vote of thanks to the Chairman concluded the proceedings.

[For remainder of Meetings see to-day's Journal.]

## GREAT ROYALTON TIN MINING COMPANY.

Mr. George Henwood, M.E., inspected this property last week, and the following is his report. It is to be observed that he fully confirms the very favourable opinions entertained of the mine, as one of no ordinary promise:—

*April* 27.—This valuable mining property promises to be the means of rendering this locality as celebrated as ever for its tin produce. No doubt can exist but the backs or surface portions of these numerous lodes and elvans have been the sources whence the enormous deposits of tin found for generations in the Goss and adjoining moors were derived, in fact the characteristics of the tin ore are precisely similar. If any confirmation of the esteem in which this portion of the county of Cornwall was held were necessary, the works of the old men extending for miles would afford abundant testimony. I know of no place where they are more conclusive. These old works are wrought to the water level; beyond that date the ancients could not penetrate. The works at Great Royalton prove that not only do the lodes hold down, but they also improve as they descend, the tin from the 32 being worth nearly double that procured in the level above. In going east towards a junction of lodes the east is now yielding very superior work. This end promises to become extremely rich. The mine at this point should be sunk 10 fms. deeper with all possible speed. There are not less than ten proved lodes in the sett, all of them east and west, or nearly so. In addition to these contra lodes run all through the ground, and the all important fact, one of the great stanniferous elvan courses of the county traverses the whole of the mine. On a geological point of view the position of the Great Royalton cannot be surpassed, being on the southern slope of the granitic boss of the Belovely Beacon hill, at the junction of the killas with the granite. It would be idle to enlarge on this fact. The lodes are so nearly situated—none more than 20 fms. distant—that all may be intersected and chained by cross-cuts; and here again a paramount advantage exists, these cross-cuts can be made by driving on the courses of the contra lodes, the produce of which will probably more than pay the cost. The sett is very extensive, being one mile and a quarter on the east and west lodes, and one mile north and south. It is bounded by mines now rising in prosperity and fame; on the east are the Bryn Royalton and Bryn Mine, on the north by the Beacon mine sett and Roche Consols, and on the west by Castle an Dinas tin mine. On the mine is a powerful engine and a battery of stamps, 32 heads, which work admirably. The engine is calculated to drive double the number and do the necessary duty for pumping also. Within a brief period these additional stamps must be erected, as there will be abundance of tin ore for them. The tin floors are economically and judiciously laid out, no appearances of costly outlay present themselves. In my opinion the state of the mine reflects equal credit upon the London and Cornish management, and the shareholders have good reason to congratulate themselves on their prospects of permanent success. The result of the last sale of tin—77*l.* per ton, and this too without burning, is most satisfactory.

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